INTERFACE AGE™

COMPUTING FOR HOME AND BUSINESS APPLICATIONS VOLUME 3, ISSUE 12 DECEMBER 1978 $2.00
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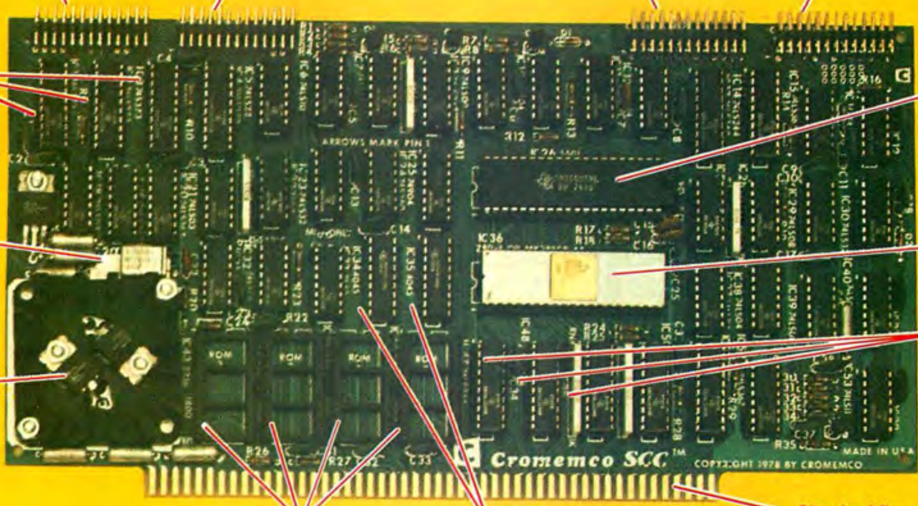

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VOL. 3, ISSUE 12
SINCE DECEMBER 1975

DECEMBER 1978

INTERFACE AGE™

COMPUTING FOR HOME AND BUSINESS APPLICATIONS

THIS MONTH'S COVER

This month's cover signifies the new focus of the microcomputer industry, the small businessman. As micros make more and more inroads to the business world, their applications are continuously being magnified and altered to fit the needs of the men and women who use them.

Fino Ortiz, our Art Director, used bright colors to signify both the electrical impulses that run the computer and the human impulses that constantly improve the micro and find new uses for it.

GENERAL FEATURES

BUSINESS FEATURES

HARDWARE FEATURES

SOFTWARE FEATURES

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EDITOR'S NOTEBOOK

ERROR BY OMISSION

That good-looking photograph we used on the October cover was taken by Robert Monkton, 429 Hill Street, Laguna Beach, California 92651, and we forgot to tell you about it. Bob is a local man and, as you can see from the October cover, does excellent work.

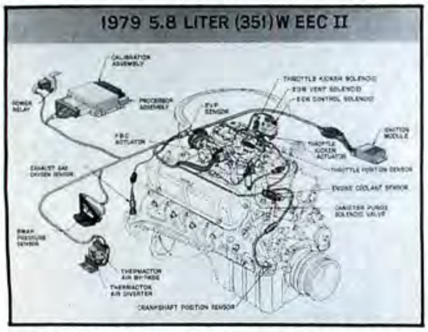
WHAT HAPPED AT THE IME?

The International Microcomputer Exposition held in Dallas this past September was probably one of the better looking shows to come off this year. Unfortunately the show suffered from lack of attendance and was a victim of world circumstances.

Originally it was planned that about 20,000 people would visit the show, but actual attendance was far below that level. Paul Tanner, the show's promoter, said that the count was around 6,600, which was fairly close to what we were able to pick up by gauging the "crowds."

What the show lacked in crowds it more than made up for in quality. The show was well laid out with carpets, lighting and sufficient power for the exhibitors' booths.

Some significant exhibitors were also present, one of which was FORD Motor Company. FORD exhibited its microprocessor controlled Electronic Engine Control system. The system uses a 12-bit microprocessor made by Toshiba to achieve the level of accuracy FORD requires.



The EEC II uses the microprocessor to achieve maximum performance from the engine by setting timing, air and fuel flow, plus making it easier for technicians to analyze a problem in the engine operation.

Another important happening occurred at the IME. Members from manufacturing and retailing met to form an industry association. If you remember, this is something that I suggested should take place in Philadelphia. An attempt was made there but to no avail. However, due to the efforts of Jim Warren, a meeting was set up and the start of a loosely knit organization was begun.

Even though this was significant, I do foresee immediate problems. Ideally it would have been nice to have had a strong leader elected to the post of president or at least someone who is willing to take the time to develop the organization and spend a great deal of time to make it work. I personally don't feel that the gentleman elected to the post will be able to carry through with the important tasks at hand.

There were actually a number of excellent choices that could have been made for the office of president. These include Joe Glover of EDS, Dan Meyer of Southwest Technical Products, or even Jim Warren. All of these men have the drive, personality and industry moxy to handle the job.

My first impressions of the association may be too cynical. I sincerely hope it becomes a major force in establishing good trade practices for the whole industry. I can only say that I occasionally make a mistake but very rarely am I wrong.

LOOK AT WHAT LYALL MORRILL DONE

Everyone talks Data Base Management but very few people have done anything about it. Lyall Morrill, the genius behind Computer Headware — that's a beanie — has done something in the form of a DBMS which he calls WHATSIT™.

The WHATSIT system is written for NORTH STAR AND CP/M™ systems and is designed to set up a true database query system. Lyall not only provides the disk software, but a listing of the NORTH STAR version in a well written, concise user's manual.

Always looking to enhance his product, Lyall is always interested in hearing what will make it better, as evidenced by his talking to Bob Bemer, who incidentally feels that WHATSIT is an excellent software tool. Those of you who are interested in learning more about WHATSIT can write to: Lyall Morrill, Computer Headware, Box 14694, San Francisco, CA 94114. If you're really interested in establish-

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- Prices: Kit, $79.95; Assembled, $99.95.

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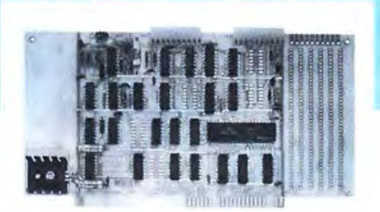
MIKBUG® Motorola, Inc.



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ing a database query system you won't be able to live without this.

A 16-BIT BUS DESIGN

Bob Stevenson, of Technico Inc., dropped me a note recently to introduce the proposed 16-bit bus standard called DUAL 61™. Technico has built a lot of flexibility into the bus design and of course is anxious for 16-bit computer designers to adopt the bus design as an industry-wide standard.

To obtain more information on the DUAL 61 bus standard contact: Bob Stevenson, Vice President Marketing, Technico Inc., 9130 Red Branch Road, Columbia Maryland 21045 or phone (301) 461-2200.

A NEW MACHINE UP ON THE QUEUE

For anyone looking for a Pascal Computer System, it looks like your prayers will be answered shortly. The system uses a new 16-bit PASCAL MICRO ENGINE™ CPU made up of four silicon gate MOS chips. The system comes complete with 64K bytes (32K words) of RAM memory, two RS-232 serial ports and two 8-bit parallel ports. The system also has a DMA floppy disk controller, self test diagnostics, and an ASCII Console.

The software is the University of California at San Diego Pascal system, plus a BASIC compiler file manager, screen oriented editor, debugger and a graphics package.

Those of you really interested in the PASCAL environment can obtain further information by writing to Computer Interface Technology, 2080 S. Grand, Grand Centre, Santa Ana, CA 92705, or call (714) 979-9923.

THIS MONTH'S COMPANY PROFILE: SWTP

Southwest Technical Products — SWTP, is a company located in San Antonio, Texas, and is known to 6800 users as one of the key suppliers of 6800 computer systems.

The company began as the brain child of Dan Meyer, president of the company, selling parts of Popular Electronics articles in 1964. Originally the company supplied kits for audio projects, then later digital projects based on Don Lancaster's designs. When Lancaster introduced the TV typewriter, SWTP offered a board set without parts.

Things really began to happen on the computer side of the house when Ed Cole developed the now famous CT-1024 terminal system for Southwest. What made things happen was the introduction of this product in January of 75, the same month Ed Roberts put the first Altair on the market. Both systems worked so well together the market was assured.

Dan, realizing the potential of the computer market, decided to develop a computer system based around the Motorola 6800 CPU, and in November of 1974 introduced the SWTP 6800 computer. The system was and is designed to be expandable and take advantage of new technologies such as the 6809 to be made available later this month.

Dan never had any illusions to providing a business machine until storage technology caught up to the rest of the industry. Now Southwest can offer systems with 5.25 or 8 inch disks and very shortly will have a system available using the Marksman hard disk drive.

Of all the companies I have had the pleasure of visiting, SWTP was one of the more exciting. The company under Dan's direction provides full customer and distributor support. The organization is set up to not only manufacture the product lines, but also has a complete metal, wood and printing shop. Dan's feeling is that a better product can be turned out and costs kept down by doing as much in-house as possible.

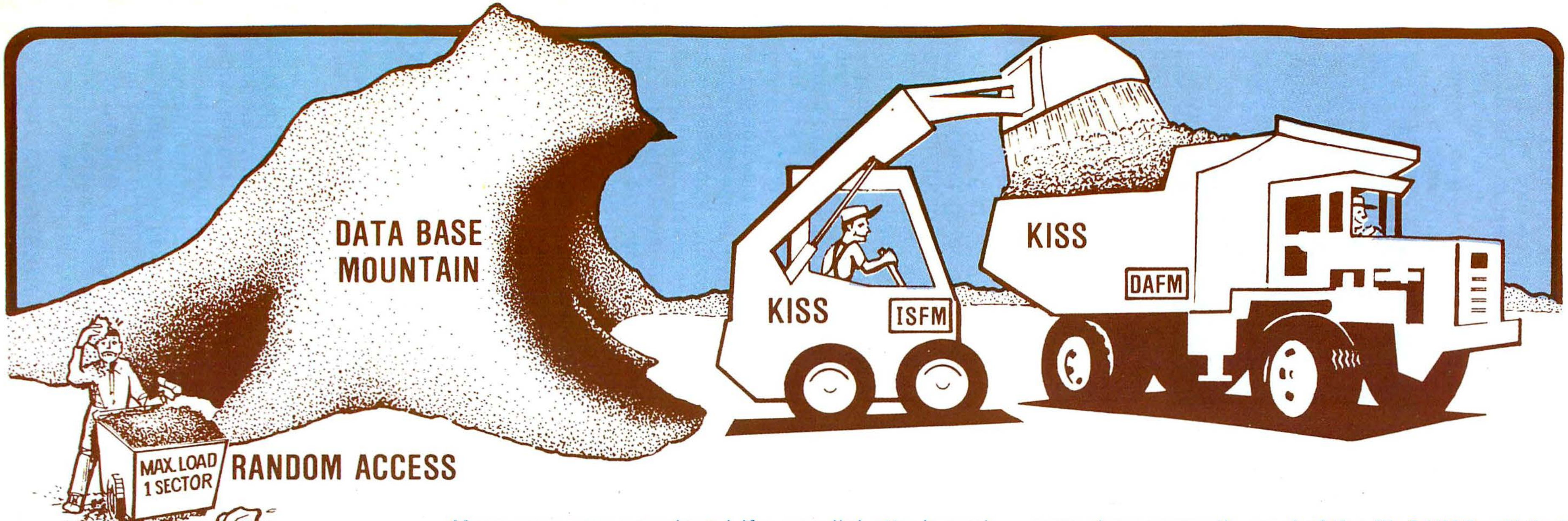
Some of the new products for this year are the hard disk system and the CT-82, a fully interactive terminal introduced at the Dallas show. Southwest also provides extremely high level software products, one of which is a very well done PILOT package.

Southwest Technical Products, one of the companies assured to be on top in the 80's.

TWO HANDY SOURCE GUIDES

Recently I was advised of two interesting books, or magazines if you wish, for users of the TRS-80 and Commodore PET. The first book, called the PET GAZETTE, is a resource and news publication for users of the PET computer. Those of you interested can find out more by writing to Len Lindsay, Microcomputer Resource Center, 1929 Northport Dr., Room 6, Madison, WI 53704.

Users of the TRS-80 will be interested in SOFTSIDE, a resource magazine that covers the available software and ideas for the TRS-80 computer. These folks can be contacted by writing to: Roger Robitaille, or Christopher E. Smith, SOFTSIDE, P.O. Box 68, Milford, NH 03055.



Have you ever wondered if your diskette based computer could operate faster? You have probably found that your machine can save money for your business, and now, a way for even more savings—in time—in efficiency—and in ease of use. The Keyed Index Sequential Search file control (KISS) has been developed by TASCON CORPORATION.

Have you ever found yourself wishing you could access your inventory system by a key other than the part number? KISS will let you do this easily, simply, and quickly; KISS *provides multi-key access.*

Have you ever found yourself waiting endlessly while a sort program is moving your general ledger entries into usable order? KISS makes these entries available *when the records are entered*—in the correct order, without sorting, through storage of another set of keys—*no waiting—no sorting!*

Have you ever waited *for long minutes* while your system was doing a sequential search of random records for a key or item and, of course, the record was near the end of the file? KISS will find that same record in a *mere 375 milliseconds, or less! Any* KISS controlled record will be retrieved in a maximum of *three disk accesses!*

Have you ever needed to conserve valuable record space, but couldn't afford space for literals—these being the tools that make the data more useful to people who do not understand computer codes? Another concern—not enough core for literal tables either! KISS lets you include *virtual table items for most any literal translation.*

Have you ever had files that were too large for one diskette and no easy way to handle multi-disk volumes? KISS makes it simple to control multi-disk volumes. Mount and swap controls are *easy to implement.*

EIDOS Systems Corporation

315 WILHAGAN RD ■ NASHVILLE, TENN 37217 ■ (615) 242-8893

CIRCLE INQUIRY NO. 21

CONSULTANTS KEEP ON WRITING

The last few weeks I have received even more letters from consultants and they are starting to look even better. Since I have a number of them this month I have elected to just list them. It's up to you to contact them for your needs.

Dr. Charles Heisterkamp III
Lex Riverbank Associates Ltd.
Medical Services Division
P.O. Box 324, Leola, PA 17540
(717) 299-1214

Michael J. Rennie Whitehead
CPU Computer Consultants Limited
1368 Chattaway Ave.,
Ottawa, Ontario, Canada K1H 7S3
(613) 731-6536

Marvin Cohn
MRC Associates Microprocessor Specialists
759 Hampton Rd., Woodmere, NY 11598
(516) 374-0062

James Williams
Another Direction
P.O. Box 87, E. Brunswick, NJ 08816
(201) 238-1333

Richard B. Auerbach
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44 Walnut Street
Little Falls, NJ 07424
(201) 256-0556

Claude Roy
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8720 Place Ray Lawson, Anjou, Quebec, Canada H1J 1Z2
(514) 353-1918

Brad Newman
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Bloomington, MN 55420
(612) 884-6744

S. B. Stafford
Allan Consulting Associates
2448 Watson Ct., Palo Alto, CA 94303
(415) 328-1400

Bob Johnson
Business Microsystems
7228 W. Reno Route 5
Oklahoma City, OK 73108
(405) 787-3020

All of these consultants listed provided us with some very impressive information and look like they can provide the necessary consulting services.

A LAST WORD

Each month I try to have some word of wisdom and this month can only say I sincerely hope all of you had as good a year as I did and that 79 brings us all the fortunes we are looking for.

HAPPY HOLIDAYS carl

LETTERS TO THE EDITOR

LOOKING FOR A CONSULTANT

Dear Editor:

I need a computer consultant who can design, structure and program time series in stocks and bonds.

I am prepared to pay a "large fee" to the right man.

Jack Allison
Box 407
Little Neck, NY 11363

Jack, I am reasonably sure this will get you some answers, but be careful on the final selection.

A PROGRAM UPDATE

Dear Editor:

RE: Gary Young's article in your August '78 issue

In Program 1, it would be easier to let Z$ = "(35 SPACES)" and, in lines like Line 6600, to use the syntax "K9$(K7,K7 + 24) = Z$". This works fine in North Star BASIC and saves a significant amount of memory and time.

Program Listing 2 will not work as published. The necessary changes are as follows:

Line 2550 should be added and should be "K7 = 1508 + (J-1)*102"
Line 2600 "READ#1,R8$ should be
Line 2600 "READ#1%K7,R8$"

As published, the program will display the same data for each name entry in the file. This change will fix that.

I have enclosed a program to sort files generated by Mr. Young's program into alphabetical order, last name first. I use the chain statement to exist Listing 1 (Line 22600: Chain "PERSORT"). PERSORT sorts and chains Listing 2.

In my program, Lines 240-440 gather data, get last name first followed by a comma, and first name. Extra blanks are moved to the end of the string. This is then used in a standard bubble sort, with K7$ being the control string. Names are entered first name first.

Henry Murphy
611 W. Illinois
Urbana, IL 61801

Henry, very interesting routine. Hopefully a number of readers will use it and contact you with their thoughts.

```
10 REM
20 REM
30 REM    PERSORT  DISK SORT PROGRAM FOR PER
40 REM    COPYRIGHT (C) 1978 HENRY MURPHY
50 REM
60 REM
70 GOSUB 690\!\!\!\!TAB(22),"READING DISK"
80 W=52819
90!\!\!"AS LONG AS THIS -> * ASTERICK IS FLASHING,ALL IS WELL "
100 DIM K9$(1500),R8$(6000),K$(35),K1$(35)
110 DIM K7$(1500),Z$(30)\Z$="
120 DIM R$(102)
130 OPEN #1,"PERSDATA"
140 READ #1,K9,K9$
150 N2=0
160 FOR S=1 TO K9
170 FILL W,32
180 REM GET LAST NAME FIRST FOR SORT PURPOSES
190 REM K7$ HOLDS <LAST NAME>,<COMMA>,<FIRST NAME>
200 REM K9$ HOLDS NAME AS ENTERED
210 REM SORT WILL BE ALPHABETICAL BY LAST NAME,BUT SAVED FILE
220 REM WILL CONTAIN THE NAMES AS ENTERED
230 REM IN THE CASE OF THREE OR MORE WORD NAMES,SORT WILL BE
234 REM BY THE SECOND NAME
240 K7=1508+(S-1)*102
250 N2=N2+1\N3=(N2-1)*25+1\N4=N3+24
260 N7=(N2-1)*100+1
270 READ #1%K7,R8$(N7,N7+99)
280 IF K9$(N3,N3)="*" THEN R8$(N7,N7+99)=Z$+Z$+Z$
290 K$=K9$(N3,N4)\FOR A=1 TO 25\IF K$(A,A)<>" " THEN 430
300 K1$=K$(A+1,26-A+1)+K$(1,A)
310 D=1
320 IF K1$(D,D)=" " THEN 340
330 D=D+1\GOTO 320
340 C=D\D=D-1
350 IF K1$(C,C)<>" " THEN 370
360 C=C+1\GOTO 350
370 E=C
380 IF K1$(E,E)=" " THEN 400
390 E=E+1\GOTO 380
400 K$=K1$(1,D)+","+K1$(C,E)
410 K7$(N3,N4)=K$\K1$=Z$\K$=Z$
420 A=100
430 FILL W,42\NEXT\NEXT
440GOSUB 690\!\!\!\!\!"SORTING DISK INTO ALPHABETICAL ORDER"
450 !\REM INTENDED FOR USE WITH MEMORY MAPPED VIDEO DISPLAY
460!\!"AS LONG AS THIS -> * ASTERICK IS FLASHING,ALL IS WELL "
470 !\!\!\!"REMAINING MEMORY= ",FREE(0)," BYTES "
480 REM  BUBBLE SORT ROUTINE--SORT BY LAST NAME
490 S1=0\N2=0\FOR S=1 TO K9-1
500 FILL W,32
510 N2=N2+1\N3=(N2-1)*25+1
520 N6=N2*25+1\N7=(N2-1)*100+1\N8=N7+99\N9=N2*100+1\N1=N9+99
530 IF K7$(N3,N3+24)<=K7$(N6,N6+24)THEN 590
540 K$=K7$(N3,N3+24)\K7$(N3,N3+24)=K7$(N6,N6+24)\K7$(N6,N6+24)=K$
550 K$=K9$(N3,N3+24)\K9$(N3,N3+24)=K9$(N6,N6+24)\K9$(N6,N6+24)=K$
560 R$=R8$(N7,N8)\R8$(N7,N8)=R8$(N9,N1)\R8$(N9,N1)=R$
570 R$=Z$+Z$+Z$+Z$
580 S1=1
590 FILL W,42\NEXT\IF S1=1 THEN 490
600 GOSUB 690\!\!\!\!\!TAB(12),"WRITING DISK...ONLY A FEW MOMENTS MORE!"
610 WRITE#1%0,K9,K9$
620 N2=0
630 FOR S=1 TO K9+2
640 N2=N2+1\N7=(N2-1)*100+1\N3=(N2-1)*25+1\N9=N2*100+1
650 K7=1508+(S-1)*102
660 WRITE#1%K7,R8$(N7,N7+99),NOENDMARK
670 NEXT
680 !"PLEASE WAIT..."\CHAIN "PIR2"
690 !CHR$(12)\FILL 55591,0\RETURN
READY
```

DIGITAL IMAGES

Dear Editor:

We are interested in buying an "image digitizing-printing" system that will print an image of a person taken from a TV camera onto computer paper. So far, we know of only one company, Computer Amusement Systems in New York, which sells such components as a complete system.

We would like the names of other companies which sell such systems, or sell the key components of such systems, so we can compare before purchasing. If you know of such companies or if you could tell us how to go about finding them, we would appreciate it very much.

Howard Egan
Small World Photos
4417 Orlan Lane
Bowie, MD 20715

Anyone know of other companies?

A ROBOT LOVER LOOKING FOR OTHERS

Dear Editor:

In the April 1978 issue, which was devoted to robotics, you said that you "were in contact with several. . . companies that are involved in robot research and development." I am very interested in this field as an engineering student and I would like to contact some of these companies.

Would you please do me a great favor and send a list of all the companies, that you are aware of, that are involved in robotics research.

Roland K. Wilhelm
Calhoun Hall, 121B
University of Cincinnati
Cincinnati, OH 45221

Roland, the list of companies and universities is relatively long, so what we decided to do was publish your address and let the robot people contact you.

ANOTHER MAN NEEDS HELP

Dear Editor:

I've attempted to put together a hard disk system over the last three months. I currently have a Vector Graphic 48K system with a Cromemco ZPU. My storage is the costly Digital Systems Dual double density disks.

The Alpha Micro AM500 S-100 interface card is the most likely candidate for the job, but on talking with the company, I find it is only sold(?) with $8,000 worth of drives that go along with it.

I located a Diablo 5 meg hard disk system only to find that Crea/Comp wanted $1,000 to build an interface card.

I found a Pertec, no interface card . . .Same for the Burroughs, CDC, and I could go on. I haven't mentioned software.

My point: Am I missing something being advertised somewhere or do I come to the realization that a decent priced S-100 interface card does not exist with a DOS? Help!

Jesse D. Parris
2367 Summer Street
Ridgeway Center
Stamford, CT 06905

Hard question. Deserves a good answer. Can somebody out there help Jesse?

IT'S FUNNY TIME AGAIN

Dear Editor:

I would like to object strongly to the word "Computerist" which is appearing in your publication with alarming frequency. It is a very awkward word to say, and unpleasant to the ears.

You would not refer to Van Cliburn as a "pianoist." Nor would you use the words "celloist" or "electronicist." They sound wrong.

Until I hear something better, I feel the words "computist" and "electronist" should be used.

John Beetem
Electronist and Computist
Stanford, CA

Son of a gun. And I thought all the time I was an editorist.

PROGRAMMERS CONTEST

INTERFACE AGE Magazine has a contest for all programmers — professional or hobbyist. The contest is to write a game based on the new television show Battlestar Galactica.

The prizes include: a two-year subscription to INTERFACE AGE and the publication of your game paid at the prevailing author rates.

HERE ARE THE RULES:

- The game must be written in assembly code for any machine of your choice.
- The game must include all the prime characters in the television show.
- The game cannot be based around ships shooting ships.
- The game can utilize graphics at the start and throughout the game.
- The accompanying article must include how to play the game, and exactly how the code works.

Each submitted game will be judged on creativity, coding style, clarity of the game instructions, and how the code works.

DEADLINE AND SUBMITTAL FORMAT

All submittals must be received at the INTERFACE AGE editorial offices not later than April 1, 1979. Each submittal must be accompanied by a self-addressed stamped envelope and an IAPS formatted tape of the code. The tape must contain both source and object code. The article must be in the format described on page 32a of the March 1978 issue.

Send your entry to Carl Warren, Senior Editor, INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, California 90701. Please no phone calls.

THE COLUMN

By Sandra Evans, Contributing Editor

I have decided to take over the world. I know that must sound like a pretty radical statement, but it seems like such an easy thing to do, it will probably be worth trying. And since I'll come out of it looking like a saviour and being loved by everyone, there isn't a single reason why I shouldn't give it my best. After all, I can see myself living in some ivory penthouse, wearing long bejeweled gowns which swirl impressively as I spin in a fit of anger like a Disney character.

The takeover is possible because I've come up with a very solid plan which I can accomplish in about twenty years. Actually, the whole thing hinges on that tiny little pocket calculator many of you already have. I'll arrange it so that everyone in the whole world will be so dependent on them they will not be able to function without them. When that happens, I'll be there to take over. It'll work, and in three simple stages too.

The first step is a simple business venture. A few pocket calculator outlets strategically placed worldwide, the best sales people money can buy and a good product will insure success. Once I get a firm footing in the retail market, I'll begin an advertising campaign that will convince everyone that my sturdy, inexpensive pocket calculator is necessary to their very existence. I'll outsell every other business, buy them out, and set up a monopoly.

My main thrust will be toward the checkbook balancer and the shopper. Calculating income and monthly expenditures will be impossible without a small computer. Eventually the calculator will be on every desk, in every wallet, in every car. A dime won't be spent without the computations done electronically; a mile won't be driven without gas mileage punched up. It'll be fantastic! Imagine a calculator served with your dinner check. You'll be able to figure what each of you owes without a doubt, right down to the tax. They'll be everywhere!

And when people no longer use pencil and paper for the simplest computations, I'll initiate stage two. And then I'll wait.

I'll introduce my little pocket calculator into every school district I can locate. They'll become the dream of every math student in the world. Computers will be embedded in their class desks, their pencils, even their bookmarks. Basic computer calculations will replace simple math, and a student will have to pass advanced computer calculations before algebra. Brighter students will go from algebra to geometry to calculus and then to arithmetic. And those bright students who can actually compute without the aid of a calculator will have quite a lucrative future with my firm. For they will be the ones called upon in the third and final stage of my scheme.

I'll wait a good ten to fifteen years before the third stage. When simple addition and subtraction has become extinct and there are no environmentalists to save them, things will start to happen. Quickly, within a week, all of the calculators will malfunction. Frantic people will run for new ones, but there won't be any.

The results will be incredible. Within the home, chaos will reign. Some will go insane simply because they can't figure out how many hours must pass before their favorite TV show comes on. Families may even starve because they can't figure their food budget. Businesses will crumble; banks will fold.

And into all this bedlam step I, with my trained crew of mathematicians and workable pocket calculators. And with a price. I will be the new leader and people will thank me. Yes, thank me. I will come with a limited supply of computers and an abundant supply of chalk and blackboards. My crew and I will teach the world a new and better way. A way of addition, subtraction, multiplication and division. A way of memorization, repetition, sweat and independence. The people will be grateful to me and they will show it.

I'll lead them from my ivory penthouse, in my swirling dresses, calculating on paper my newly acquired wealth and power. I will be there to help.□

"My Structured Systems business software has paid for itself in labor hours saved alone."

Mr. Ken Tunnah, Colloid-A-Tron Inc., Buffalo, New York

Ken Tunnah is one of many innovators bringing the micro revolution to the small business. As a programmer, he knows computers and their languages. As a businessman, he knows business and its languages. And when Mr. Tunnah decided to microcomputerize the accounting function at Colloid-A-Tron, he turned to Structured Systems software.

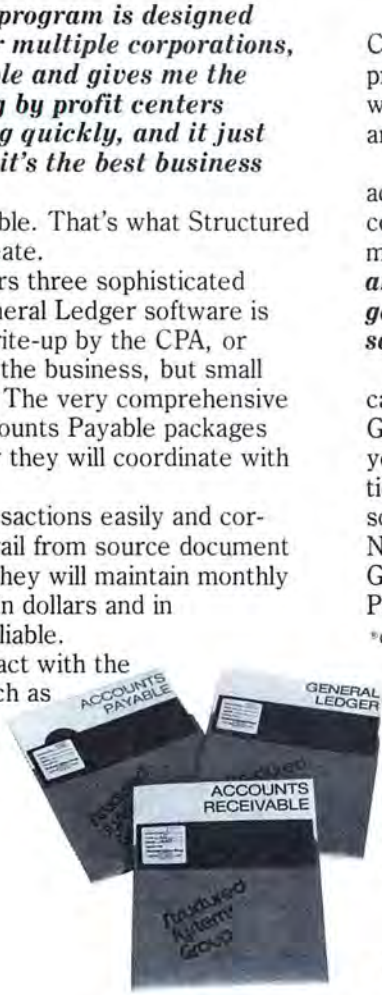
Says Mr. Tunnah: ***"The program is designed from a CPA standpoint, for multiple corporations, which we have. It is flexible and gives me the ability to change reporting by profit centers easily. It is up and running quickly, and it just keeps on running. I think it's the best business software available."***

The best software available. That's what Structured Systems Group set out to create.

Structured Systems offers three sophisticated accounting systems. Our General Ledger software is big enough for multi-client write-up by the CPA, or multi-corporate reporting for the business, but small enough for the micro budget. The very comprehensive Accounts Receivable and Accounts Payable packages will operate independently, or they will coordinate with the General Ledger.

Our systems record transactions easily and correctly, and provide an audit trail from source document to financial statements. And they will maintain monthly and year-to-date information in dollars and in percentages. And they are reliable.

The three systems interact with the user to set up parameters such as format and headings, account titles and numbering, automatic billing or reminder notices, credit limits, sales reports, a check register, and much more.



The software is designed to run on an 8080 or Z-80 CPU with 48K of memory, dual disks with CP/M®, printer, keyboard, and CRT. To make it all work for you, we have provided the most extensive documentation and support in the industry.

We provide the capability to computerize complex accounting functions on relatively inexpensive microcomputer equipment. Ken Tunnah has told us what that means: ***"I've bucked some trends. I looked around, and decided that with the right software, I could get a micro to outperform a $45,000 mini. I'm satisfied. It's simple economics."***

We can refer you to a growing number of sophisticated retailers experienced in Structured Systems Group business systems. Or we can work directly with you. We'd be happy to provide you with more information on our product line, which includes QSORT™ (a sort/merge program), CBASIC (a business BASIC), NAD™ (a mailing and addressing system), and our General Ledger, Accounts Receivable, and Accounts Payable packages.

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UPDATE

ASCII FOR HAMS?

The Federal Communications Commission is currently seeking citizen input on a proposal to authorize the transmission of ASCII by amateur radio broadcasters. ASCII, an information code comprised of seven binary data bits, has been adopted by the National Bureau of Standards as the standard code for information interchange in the U.S.

If adopted, ASCII would replace the 5-unit Baudot code currently in use. Input regarding the technical limitations, operating speed and type of transmission should be sent to the Secretary, Federal Communications Commission, Washington, D.C. 20544, before December 15.

CALL FOR PAPERS

The Eighth Annual Symposium on Incremental Motion Control Systems and Devices will be held at the Ramada Inn, Urbana, Illinois, May 21-24, 1979. A call for related papers regarding the systems has been issued by Professor B.C. Kuo, director of the Symposium, which is sponsored by the Incremental Motion Control Systems Society, in cooperation with the University of Illinois, Department of Electrical Engineering and Warner Electric Brake & Clutch Company, Beloit, Wisconsin. Exhibit space will be available.

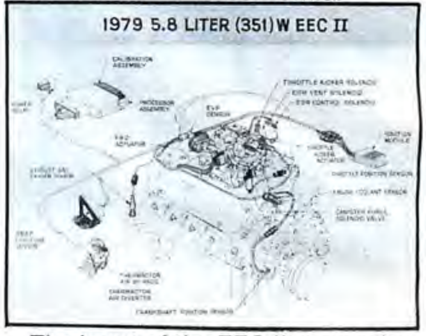
The symposium will encompass a broad area with sessions devoted to tutorial papers as well as original contributions covering step motors, machine tool control systems, computer controls, linear and AC/DC motors, clutch-brake devices and systems, and related incremental motion control applications.

The directors request authors to submit a summary of about 500 words by January 1. Final manuscripts will be due around mid-March. Send all summaries and inquiries to: Dr. B.C. Kuo, P.O. Box 2772, Station A, Champaign, IL 61820, (217) 333-4341.

ELECTRONIC ENGINE CONTROL

The second generation of an Electronic Engine Control (EEC) system will be introduced on selected 1979-model Ford Motor Company cars to meet 1980 fuel economy and emissions standards.

The EEC-II system will be installed on 5.8 liter (351-CID) V-8 engines for all 1979 Mercury Marquis and for Ford LTDs sold in California.



The heart of the EEC-II system is a completely solid state module using a digital microprocessor and other custom-designed integrated circuits. Seven sensors are used to determine crankshaft position, throttle position, coolant temperature, exhaust gas, manifold absolute pressure, barometric pressure and exhaust gas recirculation valve position. Using this information, the module calculates spark advance, exhaust gas recirculation flow rate and fuel-flow trim requirements, and sends electrical

CIRCLE INQUIRY NO. 34

signals to control the solid state ignition module, the exhaust gas recirculation valve actuator and an electric stepper motor in the carburetor.

The EEC-II microprocessor will be supplied by Tokyo Shibaura Electric Company, Ltd. (Toshiba), and by Ford's Electrical and Electronics Division.

NEW POLICE MONITOR

A new communications system being tested by the Dallas Police Department allows dispatchers at headquarters to use a display screen to visually follow a patrol car in a hot pursuit or on the way to a problem area.

The Hazeltine AVM (Automatic Vehicle Monitoring) system flashes a street map on the screen and a tiny "graphics image" flashes to show the location of the police unit as it moves along the city streets.

The computer-driven dispatch terminals display alphanumeric and special characters in seven colors, in either tabular or graphic form, using the map. There are 45 police cars in the AVM program.

MICRO LANGUAGE TEACHER

Spanish-speaking children at Gabe P. Allen elementary school in Oak Cliff, Texas, a suburb of Dallas, are being taught English by ROLAR, a microcomputer with both a display terminal and a voice.

The voice was programmed by musicians in an attempt to avoid the staccato sound of many computers so the children could learn to speak English in a normal fashion.

ROLAR is the mainstay of a pilot program started by the Dallas Independent School District and being conducted by the Foundation for Quality Education, Inc.

PET USERS GROUP

A PET users group is being formed in northern Virgina, planning periodic meetings to exchange software and techniques, and discuss problems. Interested parties should contact Robert Karpen, 2045 Eakins Ct., Reston, VA 22091, (703) 860-9116.

DESK-TOP COMPUTER IMPORTANT

A study on "Desktop Computer Markets" published by Venture Development Corporation, indicates that sales of desktop computers reached $243 million in 1977. VDC forecasts that sales will reach a level of $1.8 billion by 1983.

For more information on the report, contact Edward A. Ross, Venture Development Corp., One Washington St., Wellesley, MA 02181.

WORKSHOP FOR EXECS

All aspects of communication skills for business are stressed in "Effective Communication for Manufacturing Executives," an intensive three-day workshop on communications sponsored by New York University's School of Continuing Education will be held February 5-7 in New York City, June 25-27 in Chicago, and September 10-12 in Los Angeles.

Topics include evaluating speaking skills, making speeches and how to convince and persuade.

For a brochure and registration information, contact Heidi E. Kaplan, Dept. 20 NR, New York Management Center, 360 Lexington Ave., New York, NY 10017, (212) 953-7262.

SEMINARS ON MICROS

The Polytechnic Institute of New York and the Institute for Advanced Professional Studies are presenting a series of seminars across the country. The first, for engineers, programmers and technical managers involved with the selection of microprocessors, will be directed by Dr. Glendon P. Marston, vice president of the IAPS. "Microcomputers: Operating Principles, Hardware and Software" will be held in Dallas on December 4-5 at the North Park Inn and in Palo Alto on March 19-20.

Marston will also direct "Microcomputer Hardware and System Design," a seminar for those concerned with digital hardware design and microprocessor operation. It will be held in Dallas on December 6-8 and Palo Alto from March 21-23.

Two shows will be held at the Airport Marina Hotel in Los Angeles. "Software Engineering for Mini/Microcomputer Systems" will be headed by Paul Barr, manager of the advanced processing and system techniques department for Raytheon Company. It will run from January 11-13.

"Bit Slice Microcomputer and Digital System Design," also directed by Barr, will cover computer architecture and trends in bit-slice digital system design. It will run January 15-17 in L.A. and December 7-9 in Boston.

A five-day seminar will be held in Woburn, Massachusetts December 4-8. "Pascal Programming for Mini and Microcomputers" will be headed by George Poonen, manager of the language and data base group in the research department of Digital Equipment Corporation. The course covers programming techniques

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DACS GETS OFFICE

The Denver Amateur Computer Society (DACS) now has permanent quarters and office at 1380 S. Santa Fe Drive, Denver, Colorado 80223. The club meets the third Wednesday of every month at 7:30 PM.

For further information write the above address or call Mike Dmytrasz, President, at (303) 979-6441.

DELAWARE COMPUTER FAIRE

The Delaware Council of Teachers of Mathematics, the Delaware Teachers of Science, and the State Department Council on Computer Education are co-sponsoring a Computer Faire scheduled for Saturday, December 9, from 8:30 a.m.-3:30 p.m. at Delaware State College in Dover.

The faire is being planned for K-12 teachers, administrators, parents, and the public on the current technology for the classroom and personal use of computers.

For information contact Mrs. Lynda Baker, Computer Faire, Henry B. duPont Middle School, Benge & Meeting House Rd., Hockessin, DE 19707.

POLICY-RELATED HEARINGS CALENDAR AVAILABLE

A weekly calendar of Federal information policy-related hearings in the Legislative and Executive Branches of Government is now available through the Washington Office of the American Federation of Information Processing Societies, Inc. (AFIPS). The weekly calendar is compiled from a variety of sources and may be obtained on a complimentary basis by writing to AFIPS, 1815 N. Lynn St., Suite 805, Arlington, VA 22209, (703) 243-3000.

AFIPS is a Federation of 14 non-profit scientific, educational and professional societies representing approximately 120,000 individuals concerned with computers and their applications.

MINI/MICRO COMMITTEE FORMED

A Mini-Micro Committee concerned with developing software products and the turnkey system industry using micro and mini computers has been formed in association with the Software Industry Association of ADAPSO. The purpose of the committee is to work in the interest of member software firms and hardware manufacturers supplying software.

Issues planned for discussion include the marketing of software, software support and protection, technology transfer and training, taxation, pricing, product standards, users groups, plus other topics.

Companies interested in further information can contact Stephen M. Hicks, Chairman, Mini-Micro Committee, FORTH, Inc., 815 Manhattan Ave., Manhattan Beach, CA 90266, (213) 372-8493.

MECA USERS GROUP

Are you a MECA Alpha I tape system user? Here's a chance to share experience and get valuable information on software conversion and special systems software for the MECA System. Write to:

MECA USERS GROUP
c/o R. H. Distler
P.O. Box 6376
Oxnard, CA 93031

Be sure to include an SASE so you can be sure to receive the first fact sheet. All communication will be by MECA tape, but you will need to know how it will work. Write today.

CALENDAR

Jan 6 South Central Kansas Amateur Computer Association, 9:00 A.M., Wichita Public Library, Wichita, KS. For further information call Chris Borger at (316) 265-1120 or Dave Rawson, 1825 Gary, Wichita, KS 67219, (316) 744-1629 for further details.

Jan 6 Southern Nevada Personal Computing Society will meet at Clark County Community College, Las Vegas, NV at 12:00. The club also meets on the 3rd Saturday of the month. For further information write SNPCS, 1405 Lucille St., Las Vegas, NV 89101 or call (702) 642-0212.

Jan 7 The Computer Hobbyist Group meets at 1 P.M. in the Green Center, Rm 2.530, Univ. of Texas, Dallas. For details write P.O. Box 11344, Grand Prairie, TX 75051.

Jan 9 Okaloosa Computer Hobbyist Club will meet in the Community Room of the First Federal Savings & Loan Assoc. of Okaloosa County, 158 Elgin Pkwy N.E., Ft. Walton Beach, FL at 7 P.M. For details call (904) 242-5938.

Jan 9 Rome Area Computer Enthusiasts (RACE) meets the 2nd Tuesday each month at Patty's Stagecoach Inn, 7:30 PM. Contact Mike Troutman, RD 1, W. Carter Rd., Rome, NY 13440, (315) 336-0986.

Jan 10 Home Computers Users Group for Radio Shack TRS-80 meets at 7:30 PM. For details write or call TRS-80 Users Group Information of Eastern Massachusetts, c/o Miller, 61 Lake Shore Road, Natick, MA 01760, (617) 653-6136.

Jan 10 Homebrew Computer Club meeting will begin at 7 P.M. in Menlo Park, CA at the Stanford Linear Accelerator Center Auditorium. Contact the club at P.O. Box 626, Mountain View, CA 94042, (415) 967-6754 for details.

Jan 10 Blackhawk Bit Burners Computer Club meets on the second Wednesday monthly at 7:15 PM in Rockford, IL. For more information contact Frank D. Dougherty, 325 Beacon Dr., Belvidere, IL 61008, (815) 544-5206.

Jan 11 Mid America Computer Hobbyist meeting will be at 7 P.M. at Commercial Federal Savings & Loan, Bellevue NE. Intersection of Galvin Rd. and U.S. Hwy. 73-75. Write P.O. Box 13303, Omaha, NE 68113 for further information.

Jan 11 North Florida Computer Society will meet at 227 Edison Dr., Pensacola, FL 32505. For details write this address or call Eugene Rhodes at (904) 453-3844.

Jan 11 The Rochester Area Microcomputer Society will meet at the RIT Campus, Rm. 1030, Bldg. 9 at 7:30 P.M. For details write RAMS, P.O. Box D, Rochester, NY 14609.

Jan 11 Utah Computer Association will meet at Murray High School, Rm 154, 5440 S. State St., Salt Lake City, UT at 7 P.M. For details write or call Larry or Holly Barney, 1928 S. 2600 E., Salt Lake City, UT 84108. (801) 485-3476.

Jan 11 The New York Amateur Computer Club meets on the 2nd Thursday of each month at Bernard Baruch College, Rm. 903, 17 Lexington Ave. (corner 23rd St.), New York, NY at 7 PM. For more information write P.O. Box 106, Church St. Station, NY, NY 10007.

Jan 12 HAUCC will meet at 7:30 PM in Rm 117 of the Science & Research Bldg. of the main campus of the Univ. of Houston. For more details write or call P.O. Box 37201, Houston, TX 77036, (713) 661-6806.

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Adares Micro Computer Systems
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Bakersfield, 93308
Phone (805) 393-1326

* Advanced Computer Products
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Santa Ana, 92705
Phone (714) 558-6813

Anchor Electronics
2102 Walsh Ave.
Santa Clara
Phone (408) 246-3696

Byte Shop Computer Store
3400 El Camino Real
Santa Clara
Phone (408) 249-4221

Byte Shop of Palo Alto
2233 El Camino Real
Palo Alto, 94306
Phone (415) 327-8080

Computrend
Box 2541-K
Anaheim, 92804
Phone (714) 533-3572

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4670 N. El Capitan
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Phone (209) 266-9566

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P.O. Box 9641
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5716 West Manchester #5
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9100 Sunset Blvd.
Suite 112
Hollywood, 90069
Phone (213) 271-9726

* Jade Computer Products
4901 West Rosecrans Blvd.
Hawthorne, 90250
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San Bernardino
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419 Portofino Avenue
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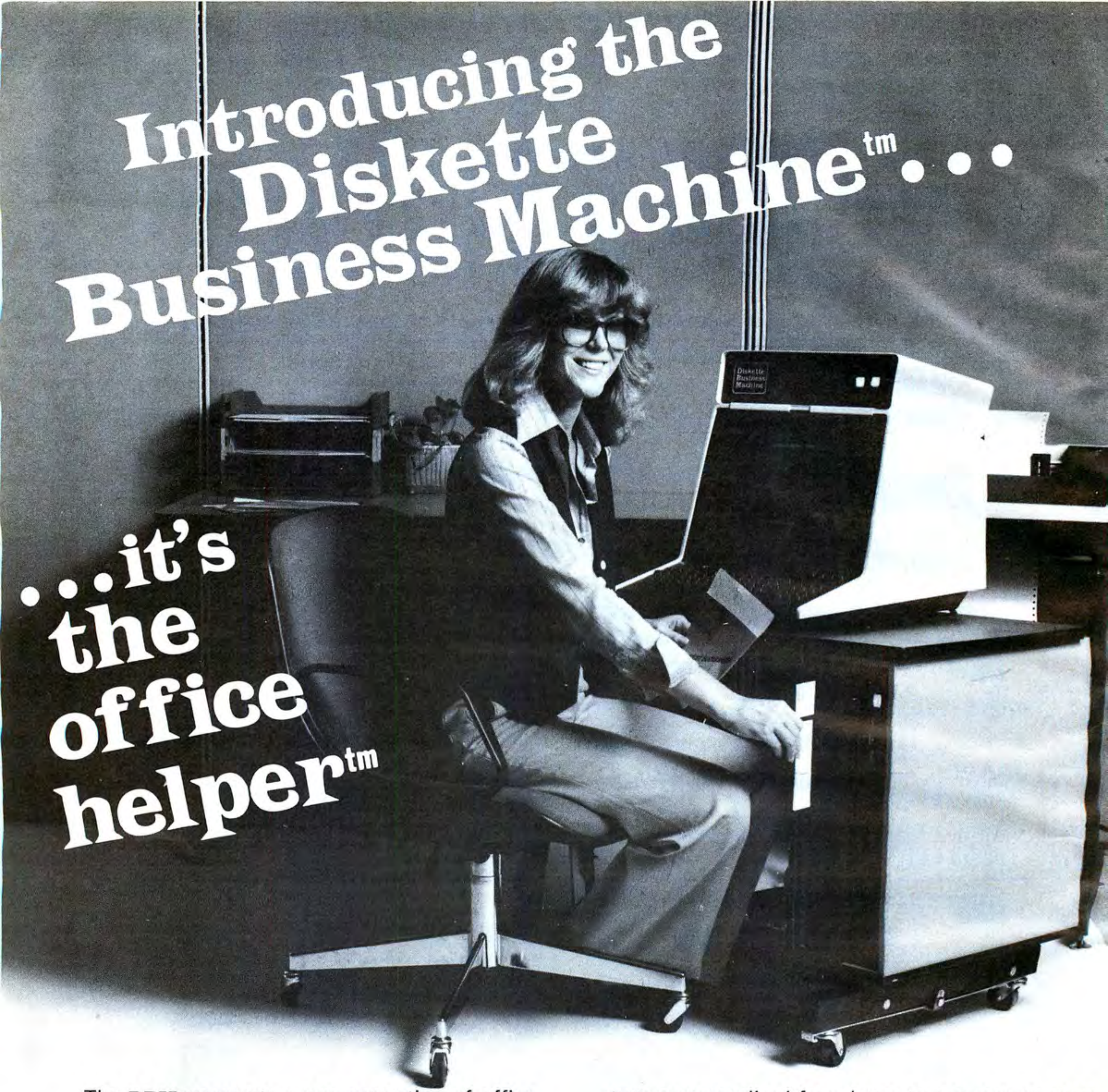

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Jan 12 Northern New Jersey Amateur Computer Club (NNJACC) meets at Fairleigh Dickenson University, Rutherford Campus, Becton Hall, Rm B8 at 7 PM. Write to 593 New York Ave., Lyndhurst, NJ 07071.

Jan 13 The Permian Basin Computer Group — Odessa Chapter meets at 1 P.M. in the Electronic Technology Bldg., Rm 203, the Odessa College campus. For more information contact John Rabenaldt, Box 3912, Odessa, TX 79760, (915) 332-9151.

Jan 14 North Orange County Computer Club meets at Chapman College, Orange, CA, at 12:00. 105 Hashinger Hall Auditorium. Membership Chairman, Tracey Lerocker, (714) 998-8080 evenings. For details write P.O. Box 3603, Orange, CA 92655.

Jan 16 Rhode Island Computer Hobbyists (RICH) meets the at the Knight Campus of Rhode Island Junior College in the Faculty Cafeteria at 7:30 P.M. For details contact Emilio Iannucillo, RICH, P.O. Box 559, Bristol, RI 02809, or call (401) 253-5450.

Jan 18 Madison Computer Society will meet at 7:30 P.M. at 2707 McDivitt Rd., Madison, WI 53713. Mike Shoh, president.

Jan 18 Sacramento Pet Workshop meets from 7-10 P.M. the third Thursday of each month. For more information contact David Howe, (916) 445-7926.

Jan 19 Amateur Computer Group of New Jersey (ACGNJ) meets at UCTI, 1776 Raritan Rd., Scotch Plains, NJ 07076 at 7 P.M. For details write to the club at the above address.

Jan 19 Long Island Computer Association meets at 7 PM at the New York Institute of Technology, Old Westbury Campus, Route 25A between Route 107 and Glen Cove Rd., Rm. 508. For more details write Long Island Computer Association, 36 Irene Lane East, Plainview, NY 11803.

Jan 20 Computer Hobbyist Group of North Texas meets at UTA University Hall, Rm 108 at 1 PM in Arlington, TX. For details contact Neil Ferguson at P.O. Box 1344, Grand Prairie, TX 75051, (817) 387-0612.

Jan 20 Philadelphia Area Computer Society will meet at 2 PM at LaSalle College Science Bldg. at the corner of 20th & Olney Ave. For more details write PACS, P.O. Box 1954, Philadelphia, PA 19105.

Jan 20 The 7C's Committee (Affiliated with the Cleveland Digital Group) will meet at Cleveland State University Student Services Bldg., in the Kiva Room at 2:00 P.M. For more information write to Cleveland Digital Group, 8700 Harvard Ave., Cleveland, OH 44105.

Jan 20 San Diego Computer Society meets at Grossmont Community College Student Center, 8800 Grossmont College Dr., El Cajon, CA at 12:30. For details write P.O. Box 9988, San Diego, CA 92109, or call (714) 565-1738.

Jan 21 Central Florida Computer Club will meet at 2010 Fosgate Dr., Winter Park, FL 32789 2:00 PM. Contact Bill Kerns for further information.

Jan 21 Cleveland Digital Group meets at 2 P.M. in the old railroad station at Safier's Inc., 8700 Harvard Ave., Cleveland, OH 44105. Write the club at this address for more information.

Jan 23 Computer Amateurs of So. Jersey will holds its meeting at the National Park Municipal Bldg., 7 So. Grove Ave., National Park, NJ

at 7:30 P.M. For details call (609) 541-1010, or (609) 541-8296.

Jan 23 Okaloosa Computer Hobbyist Club will meet in the Santa Rosa Rm, in the Santa Rosa Mall, Mary Esther, FL at 7 P.M. For details call (904) 242-5938.

Jan 23 Sacramento Microcomputer Users Group, (SMUG), 7:30-9:30 P.M. at SMUD Training Bldg., on 59 St. Write Richard Lerseth, P.O. Box 161513 or call (916) 381-0335 after 5:00 P.M.

Jan 24 Boston Computer Society will meet at the Commonwealth School, 151 Commonwealth Ave., Boston at 7 P.M. The school is located on the corner of Dartmouth St. in Boston's Back Bay. For information write or call the society at 17 Chestnut St., Boston, MA 02108, (617) 227-1399.

Jan 24 Diablo Professional Users Group (DPUG) will meet at Diablo Valley College Library, near the Willow Pass exit of Fwy. 680, from 8-10 PM. For details write or call Bob Hendrickson, Electronics Dept., DVC, Pleasant Hill, CA 94523; (415) 687-8373.

Jan 24 Ventura County Computer Society will meet at Camarillo Public Library, 3100 Ponderosa Dr., Port Hueneme, CA 93041 at 7:30 P.M. For more information write: VCCS, P.O. Box 525, Port Hueneme, CA 93041.

Jan 25 Space Coast Microcomputer Club will meet at 7:30 PM at the Merritt Island Library, Merritt Is., FL. Contact Glynn Mills at R3, Box 904, Merritt Is., FL 32952 for more information

Jan 25 Small Computer Engineering Association of Minnesota (SCEAM) will meet at the Resource Access Center, 3010 Fourth Ave. So., Minneapolis, MN 55408 at 7 P.M. For more information write to this address or call (612) 824-6406.

Jan 26 Alamo Computer Enthusiasts meet at 7:30 PM in Rm 208 at Naylor Technical Center, St. Philip's College, San Antonio, TX. For details call (512) 532-2340, or write to the club at 5411 Cerro Vista, San Antonio, TX 78233.

Jan 26 Washington Amateur Computer Society will meet at the Catholic University of America, St. Johns Hall, located at Michigan and Harewood Aves. in Washington, D.C. Contact Bill Stewart at (202) 722-0210 for club details between the hours of 10 A.M. and 12 P.M.

Jan 28 Birmingham Microprocessor Group will meet at Southcentral Bell Company headquarters bldg. at 2 P.M. For further details write or call Jim Anderson, 2931 Balmoral Rd., Birmingham, AL 35223; (205) 897-9630.

Jan 28 Summit City Computer Club will meet at the McMillen Library on the Indiana Institute of Technology Campus in Ft. Wayne, IN. For more information write the club at P.O. Box 5096, Ft. Wayne, IN 46805.

Jan 30 The Digital Group Group meets the last Tuesday of each month in the meeting room of Consumer Systems at 2107 Swift Rd., Oak Brook, IL at 7:30 PM. For more information write the group c/o William L. Colsher, 4328 Nutmeg Ln., Apt. 111, Lisle, IL 60532.

Jan 30 The Apple Portland Program Library Exchange (APPLE) meets on the last Tuesday of each month at 7:30 PM. For location and details contact Ken Hoggatt, 9195 SW Elrose Ct., Tigard, OR 97223, (503) 639-5505 or (503) 644-0161, Ext. 6136.

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FROM THE FOUNTAINHEAD

By Adam Osborne

Small business systems currently constitute the largest single market for microcomputers. I am surprised to see microcomputer systems sell so well in the small business data processing market while there is still so little good applications software. But I believe the applications problem will be solved during 1979 — at which time microcomputer system sales into the data processing market will increase enormously.

In order to find a solution for the lack of applications programs, we need only look at how system software developed. Gary Kildall's CP/M has become the "de facto" standard operating system for the microcomputer industry. You may argue that better operating systems are available, but who cares? CP/M is certainly adequate, and everyone is using it.

Gordon Eubanks' CBASIC and Bill Gates' Microsoft BASIC are rapidly establishing themselves as the "de facto" standard programming languages. MITS 4.1 BASIC is crippled by the fact that it is exclusively a Pertec (ex-MITS) language; therein lies the secret of the microcomputer industry. To survive you must run with the pack. Every time a company designs its own unique hardware, operating system or software, it spends additional money putting itself out of business.

Those microcomputer manufacturers who are busy developing their own operating systems and programming language variations would do well to quit. They are wasting a lot of money, and they are seriously jeopardizing their chances of remaining in business. Spend the money instead becoming compatible with every "de facto" industry standard that can be identified — and when it comes to software that includes CP/M, CBASIC, and Microsoft BASIC.

But what does this have to do with applications software?

The answer is that by mid-1979 there will be "de facto" standard business applications programs in general use. These "de facto" standard business applications programs will be low-cost, canned packages that will run on any popular microcomputer system. By low-cost, I mean $50 or $100 per package to the end-user. At that point, the computer store will be able to assemble a computer system, move it into a customer's office, and have it do useful work within 48 hours. People will be buying and using computer systems the same way they buy and use automobiles. You do not wait 9 months to start driving your new car. And there is no good reason why you should wait 9 months to start using your new computer system.

Those of you who have been around the computer industry for many years may be surprised to see me support the concept of "canned" packages — a concept which has never really been successful to date. I believe "canned" packages will be successful in the microcomputer industry, although they were unsuccesful in the minicomputer and mainframe industries, because the microcomputer industry presents a whole new set of economics.

A minicomputer buyer who spends $50,000 on his hardware and $10,000 on a set of canned packages is not likely to be frightened by programmer charges of $25 per hour, or more, for custom changes. The very fact that canned packages were generally unsuccessful in the minicomputer industry caused these packages to be designed as a framework in need of customizing, rather than a complete system.

Canned or not, packages frequently took six months to bring on-line; and that was six months of frustration during which the minicomputer buyer saw his $60,000 investment drain his time and patience. By the time the computer system started to do any useful work, the buyer was almost vindictive in his determination to get as many hours of customization as possible, and to pay for as few of them as possible.

But microcomputer systems may cost $10,000 or less; and a set of canned packages may cost $100 or $200. If the computer store retails this system correctly — and I will address that subject next — the customer's $10,000 investment will start doing useful work from day one. And after paying just $100 or $200 for canned packages, $25 per hour for changes will look like a whole lot of money. This new breed of customer will be more willing to adapt to the canned package because these packages finally make economic sense.

The key to selling low-cost, microcomputer-based business systems is to make a profit on every sale, and to make sure that the customer gets a working system within 48 hours. It is in the customer's and the computer store's interest that the seller make a profit on the transaction. Otherwise there will be no after-sales service or support and the customer might just as well go back to buying $50,000 minicomputer systems directly from the manufacturers.

It is in the customer's and seller's interests that the computer system start working within 48 hours; that way a long-term relationship starts harmoniously.

If the seller is to make a profit on every system, and if the customer is to get a system that starts working at once, then we need to re-think the economics of selling computer systems out of stores. And that should be no problem; the computer store itself is a revolutionary idea. It should come as no surprise to the customer that buying a computer *from* a store is not the same as buying it at the tail end of six harrowing months interviewing salespeople *and* reading their glossy brochures.

The minicomputer salesperson is selling a promise.

The computer store must sell a product.

The minicomputer salesperson cannot let you see, touch, and feel what you are buying, because necessary programs do not normally exist. A customer must therefore buy on faith, which immediately puts the transaction into a grey area where no one is sure what has or has not been paid for. But if you buy a computer system from a computer store — complete with working programs — you see what you are getting; and you, *the customer*, should expect nothing more than what you see for the price you pay.

And therein lies the key to operating a computer store successfully. When a customer buys a computer system, what the customer sees is what the customer should get, and no more. Any computer store owner *who promises* additional free services, such as training the customer or writing unknown programs, will *go broke* and will deserve to.

The industry is better off without such dealers. The moment a store starts offering additional unknown services as an inducement to sell a computer system, the store has just agreed to do an unknown amount of work for a fixed sum of money, with the possibility of being paid in the customer's will.

I urge all computer stores to adopt the following policies:

- Charge a fixed price for a fixed product and do not misrepresent the product in any way.
- At the time of the sale, explain to the customer that there is an installation charge. It might be a fixed sum for a known system, or an hourly charge for a system with any special features.
- Charge by the hour for customer training. Neither you nor the customer has any idea how much training the customer's personnel will require. How can a store bid a fixed sum for an unknown amount of work — or a job that can never be defined as complete?
- Charge the customer by the hour for all programming changes. But make no such changes until the customer understands the "canned" programs completely and can request changes from a basis of knowledge and understanding.
- At the time of the sale, explain the hardware service charge to the customer. This may be an hourly charge, in which case time should start when your personnel leave the store, and time should end when your personnel return to the store. Alternatively, service may be offered for the monthly or annual contract price.

I strongly urge all customers to do business only with stores that adopt the policies I have identified above. You, the customer, may well be tempted to do business with a new operation that promises everything your heart may desire — for a fixed fee. But what good will it do to try and enforce this agreement when the seller is down to eating money or has filed bankruptcy?

Jim Schreier has just published his newest software index. It is a handsome book, much larger than his first one — which is only to be expected. For its small cost, this software index is a must in any microcomputer user's library. You can get one by writing to:

The Schreier Software Index
4327 East Grove Street
Phoenix, AZ 85040

A few months ago I told you of a new cassette-based magazine for Commodore PET: the "Cursor". We have now received the first few issues of this magazine. If you are using your PET primarily to play games, you will find Cursor well worth the $15 annual subscription fee. For more information contact:

"Cursor"
Box 550, Goleta, CA 93017
(805) 967-0905
Ron Jeffries, Publisher

I have started to receive letters from readers praising the good guys. An important letter came from Jeffrey Bishop of University of Calgary. Mr. Bishop says:

"We have about $120,000 sunk in a project using mainly Altair stuff and of all the people we have dealt with, Tarbell remains the most amazing — his level of enthusiasm, knowledge, and helpfulness is very high. He is a real asset to the field." Don Tarbell may be reached at:

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□

JURISPRUDENT COMPUTERIST

By Elliott MacLennan
Attorney-at-Law
Stephen Murtha

MAXIMIZING YOUR TAX BENEFITS FROM RESEARCH AND DEVELOPMENT COSTS

QUALIFYING FOR AN R & D WRITE OFF

An essential prerequisite for any R & D deduction is that you be in a trade or business; amateur inventors do not qualify. Once you have some existing business, you may deduct, amortize or capitalize research and development expenditures for new products or processes even if they are unrelated to your current product line or manufacturing process. Therefore, once you are already in business, R & D expenses may be deducted even though they are a prelude to going into a new business.

SELECTION OF METHOD

Three choices are available to write off your R & D costs:

1. current expense
2. 60-month amortization
3. capitalization over useful life of what you create

Why three alternatives? The answer is timing. You select the timing of the deductions to correspond to the receipt of income to your firm. Perhaps a simple example would be helpful. In year one, you create a new product after expending substantial effort and capital. However, marketing research indicates you will receive little or no income on the new product until year two and through year seven.

Taking a current deduction in year one would not be appropriate because there is no income to offset the R & D deduction. The idea is to ambush the income from new products in the year when that income is received. You may not need the deduction in year one because your tax rate is marginal because of other tax deductible items. Therefore, why use a deduction, for example, in the 25% bracket when it can be deferred and used in the 48% bracket?

Current Expense Method

The current expense method of R & D expenses may be adopted without IRS preconsent only if you take the deduction on your business income tax return in the year that you pay or incur R & D expenses. Caution: Failure to take the current deduction can result in its complete loss unless a timely refund claim is filed with the IRS for the appropriate year.

The IRS "prefers" that you separately state all R & D deductions. Whether or not you and your income tax preparer choose to do so in all cases, you should segregate R & D cost on your books to permit easy verification.

Note also that although you elect the current expense method for tax purposes, you need not (and in some cases cannot) keep your books on the same method. You must, however, be able to reconcile the differences to Internal Revenue Service agents.

Once the current expense method is elected, you must treat all future R & D costs by this method unless the IRS' permission is secured in advance.

In contradistinction to the timing example given above, would there ever be a situation where, even though you do not anticipate income until after year one, the year that you incur R & D expenses, you would want to take the deduction in the current year, year one? Yes, two situations actually. Both involve business judgments to override tax effect.

One, where you seek investors to capitalize your R & D costs, you may want to elect the current expense method and pass on the deductions so created to your investors as a tax incentive to underwrite your product experiments. (You know Frankenstein was the R & D result of a limited partnership whose purpose was to design a better human being, but capital ran out.) Investors like tax incentives because they feel the benefit of their investment on April 15 even though the income return on the new product may be months or years away.

The second situation is simply a decision to take the current deduction and not defer it where you have fluctuating and unstable income projections.

Deferred Expense Method (or 60-month amortization)

Selection of this method allows you to postpone the R & D deduction until you first begin to realize new product income. You control when this amortization commences. You can elect this method only with the consent of the IRS. Once elected, you cannot amortize your R & D costs over less than 60 months and then only if the product or process created does not have an ascertainable useful life for tax purpose.

You can elect this method but not state the month that you want the amortization period to begin. This decision can be by hindsight, i.e. years after this method

has been adopted you can decide when benefits from your expenditures are first realized.

It is advisable to use this method when current income is at a low level or insufficient to absorb the deduction. Additionally, this method serves to provide deductions to ambush the receipt of income when that income is received; income distortion for tax or accounting purposes does not occur.

(You know Frankenstein was the R & D result of a limited partnership whose purpose was to design a better human being, but capital ran out.)

Capitalization of R & D Costs

This method is not elected but rather imposes itself mandatorily where you do not elect either the current or deferred expense method. It works this way. You incur and pay $7,000 in R & D expenses to create a product with a useful life of seven years. You may deduct $1,000 each year for several years.

The IRS has held that in connection with R & D expenses, costs of electricity and laboratory materials, traveling expenses, rent, and engineers' salaries are capital assets, not ordinary and necessary business expenses which would be currently deductible.

COMBINATION TAX TECHNIQUES

Like the chap who knows his horse will come in for the money but he is not sure where, he buys a win, place, or show ticket, you should seek IRS permission to select a different method if several R & D projects are in various stages of development. This is known as the "straddle" position.

The key to gaining IRS permission is to classify your R & D expenditures into separate and distinct projects. Then request a different method for the projects in accordance with tax timing or investor placation considerations.

SOFTWARE R & D COSTS

The sole exception to the three methods already discussed is software. Where you can "clearly establish" that the software has a useful life of less than 60 months (but more than one year), there is a fourth method. This is to say that you have four different timing choices to offset the receipt of income.

Throughout this column, we have used the term "new products". You need not create a new product; an improvement to an old product will qualify for the R & D deduction.

RESEARCH AND DEVELOPMENT FAILURES

Where your efforts and expenditures come to naught, you may, as a general rule, deduct as a loss under Internal Revenue Code Section 165 the remainder of expenses that you have not already deducted. For example, you have capitalized the cost of your R & D expenses amounting to $50,000 over a 10 year useful life by deducting $5,000 per year. After two years and $10,000 in deductions, you realize that "you are ahead of your time" and that there is no ready market for converting your toaster into a dual disk drive suitable for Arctic climates.

In the third year, if you can demonstrate the intent to abandon coupled with the cessation of activity in connection with the project, you can take as a loss the unamortized $40,000. Moreover, suppose you don't need a loss of $40,000 in year three but do in year four? Abandon the project in that year.

RESEARCH DONE BY OTHERS

You can deduct the costs of R & D performed for you by independent organizations or contractors as long as you do not acquire from the researcher depreciable property. The IRS has often been successful in denying deductions in this area where the development costs paid to the researcher were loans and not risk capital. The key to your success when you pay another for R & D is to have the element of economic risk present. Where your investors capitalize your R & D expenditures, make sure that the legal documentation reflecting your agreement with them cannot in any way be classified as a loan to you.

To close on a positive note, if the information obtained from an unsuccessful project is used for a later successful effort, the IRS will not require you to go back to the year you took the loss and reverse it out.☐

The material presented in this column is intended for the reader's general information. The authors request that the reader consult professional advisors prior to applying this material to his or her specific situation. Anyone needing further information can contact the authors directly at:

Elliott MacLennan, 2855 Mitchell Dr., Suite 130 Walnut Creek, CA 94598

Stephen Murtha, 3 Altarinda Dr., Suite 304 Orinda, CA 94563

Call it what you will — intelligence amplifier, mind amplifier, intelligence leveler — but the advent of small, cheap information processing is an event unique in human development. No area of expertise will be spared its pervasive influence, no profession will continue to capitalize on the ignorance of the population at large. Nowhere will this influence be more disruptive of status quo than in the vast health-industrial complex.

Information processing is about to invade the most conservative of professions, medicine, and this process will change the nature of health care delivery. This will not happen overnight but will be an evolutionary process. Presently there are only a handful of physicians using information processing in routine practice (outside the hospital), and even then most applications to date have been accounting or small business functions.

There is a curious convergence developing at present. Physicians are just beginning to discover the possibilities of computers and have the same curiosity as the thousands of private citizens who are concurrently exploring this fascinating technology. I believe there is a mutuality here not previously explored outside esoteric medical and biocomputing journals. Health care and the impact of information processing on it are of universal interest, and I believe the time has come for physicians, other health professionals and the mass of intelligent laymen with interests in personal computing to start a dialogue on the future of this activity.

Many physicians are not subscribers to personal computing magazines. I hope this trend develops because I believe a forum in this medium can be an exciting and entertaining process for all involved. The outcome of the use of information processing in health care activities is too important an event to delegate only to anonymous centralized bureaucracies in the "Ministry of Health" (which will soon be upon us)! The dialogue must begin as the process begins. Health care professionals and industry-sponsored information processing personnel will clearly have significant parts to play, but I believe they can never provide all the answers and direction as this process develops.

This is the first in a series of columns devoted to the creation of a forum for all the aforementioned parties to exchange ideas relating to the use of this technology in health care. It is a chance for all concerned to participate in an adventure whose horizon is limitless and an opportunity for non-medical people to influence the evolution of health care delivery in the post-industrial society.

I believe this process coincides with a larger process presently underway in North America. Citizens are beginning to take back responsibility for their own lives and health. Numerous books and articles are appealing to the public to recover the medical independence of an earlier era. In health matters our society has become almost incapable of bearing the least symptom without seeking professional advice on treatment from some health agency.

High volume, low cost (relatively) technology will allow us and our children access to all of the "guild secrets" and make rational decisions without professional input. I am not advocating diagnosis without medical input. This is foolish! However, a more rational system of health care awareness and understanding is imperative. The plain fact is that this process will develop regardless of how it is resisted. The rational thing to do is direct it with *all* interested parties involved.

The computer is a tool with infinite possibilities for allowing both doctor and patient to understand and effect more healthy lives. The future of health care in North America implies a greater understanding and use of information not widely available in the prevention and maintenance of health. The front line is the home, not the doctor's office or hospital.

At some future date there will be vast medical data bases. These will be accessible to health professionals, and hopefully citizens as well. How will it evolve? Who will pay for it? These and other questions are central to the theme of this dialogue. Other questions we must ask:

- is such a forum valid?
- should the future of medicine include information processing and its potential for dehumanization? Can we control the outcome?
- will dialogue among interested personal computing layman and health care professionals have any effect on the future of medical computing?
- what is the role of a data processing the future health care system?
- how much responsibility can a nonprofessional take for his life (assisted or not by information technology)?
- is such a dialogue possible in any other medium besides personal or "consumer computing" literature?

We have observed that the sophistication of the general public in medical matters is moving faster than most physicians would like to contemplate. The readership of personal computing magazines represents a particularly intelligent and articulate constituency and will inevitably be involved in projects which might be of a medical sophistication embarrassing to their personal physicians. Thus, physicians must become aware of what technology is making possible. If this dialogue does not occur, we will get into a subject close to my heart, "technological bypass." I hope to elaborate on the consequences of such a situation in future columns devoted to the exploration of home systems and "personal biocomputing."

I plan to explore the requirements of systems used for biocomputing. We will get into medical judgement and therapeutic rationale. We will review the progress in both academic biocomputing to date and regular office functions, and we will consider the state of the current art in applying small systems to this environment. I hope to discuss the success and failures of small and large systems in these applications and the reasons for these successes and failures. We should try to dissect reality from the utopian expectations in all these developments.

I hope readers will offer their comments on any subject as we develop this dialogue. No suggestion or thought is too naive or impractical. One of the great joys of medicine is its diversity. So many innovations are yet to be initiated; this will be a very large industry in the future. Consider the worlds we are moving into:

- wrist-worn physiological monitoring systems
- personal cardiogram analysis
- risk-factor analysis
- noninvasive diagnosis of wide spectrum
- work environment risk inventories
- life performance trajectories

The list is endless but we will try to get into all of it. □

Write to Wm. V. Weiss, M.D., President, Biolothics, 600 Sherbourne St., Suite 803, Toronto, Ontario M4X 1W4.

CIRCLE INQUIRY NO. 3

White Collar Microcomputer

By James S. White

To complete this year, the dawn of history for business microcomputer, it is important to stop and reflect on the course of events that brought about the micro business revolution. At the same time, try and see how these events have forecast the future.

Whatever kind of computer systems today qualify as small business computers do so principally because of their software. This fact is partly a result of the recent history of computing in general: it has proven easier and quicker to specialize computer system software than hardware, at least when one considers today's production and distribution constraints, and the acceptance of today's typically primeval software. Of course, this software emphasis is also a result of the large computer production and marketing approaches, which have abandoned the historical philosophy of specialized hardware, and now specialize via software.

However, what is true of large computers need not be true for small computers. Where a large computer must be many different things to many different people so its large cost can be distributed among many users, a small/micro computer can be afforded by one individual. This cost can also result in the economies of scale needed to economically produce several kinds of computers, because many different kinds of small computers can each sell more units than the best-selling large computer.

Buyers in the future can expect to pay more for computer systems. One part of the total system cost, hardware prices, will probably continue to drop. . .

A point for prospective computer system buyers to consider is that there can be considerable value in specialized hardware, despite its present lack of common availability. Retail users of larger computers in some environments, for example, use tag readers and various types of point-of-sale equipment.

Two other areas of obvious potential for specialized hardware are inventory status updating, and efficient interconnection of several small computers so individual users can have all the computing power they need, but share it with others when less or none is needed by the "owner".

For 1978, we are limited to caveats, such as that business systems must have a printer. However, such rules

will soon be questioned, as we better understand that traditional techniques aren't always the best basis for the use of new tools.

Costs continue to be an interesting consideration. Business computer systems today cost less than at any time in the past. However, prices aren't as low as initial appearances imply. The $600 computers, first available this year, have limited use. For some business applications, a programmable calculator can do a better job at much less cost. But even these $600 systems do have some worthwhile business applications, despite the often-heard statement that they are only toys.

As 1978 ends, the computer systems most useful for the typical small business are the packaged systems in the $15,000 range. A few have recently become available, and more will be marketed soon. These systems have the quality, the features (hardware, software, and documentation) and the support that the *typical* business needs. For most companies, accepting a *system* which cuts corners means that the business must compensate by expensive do-it-yourself work. Therefore, a complete system is often most economical.

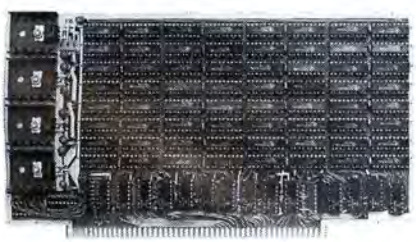
Buyers in the future can expect to pay more for computer systems. One part of the total system cost, hardware prices, will probably continue to drop, but not dramatically without major new breakthroughs. The steady but slow cost saving effect of technological refinement will do little more than keep ahead of inflation.

But software will be the factor causing price increases. As vendors and buyers realize how inadequate today's software is, they will add the capabilities users need to have a helptul tool. Despite the increasing customer base these development costs will be spread over, the net result will be higher system prices. For the buyer, the results in productivity and utility will be more than worthwhile.☐

S-100 Memory for peanuts, Artec has slashed its prices!

Until ~~November~~ 15th–32K for $620, 16K for $315–Assembled.

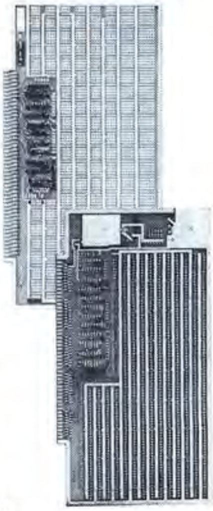
No matter what your needs, Artec has a memory board for you. You can start with 8K of TI 4044 memory on a 5.3" x 10" card and work your way up to a full 32K in 8K increments. The access time is only 250ns. The memory is addressable in 4K blocks and is perfect for S100 and battery augmented systems. The Artec 32K Expandable Memory has four regulator positions, bank select and plenty of room for all necessary support hardware. It uses less than 1 amp per 8K of memory (3.9 for 32K), and only +8 volts.



BOARD	KIT	ASSEMBLED
8K Memory	$150	$175
16K Memory	$265	$315
24K Memory	$400	$475
32K Memory	$520	$620

Add-ons: $135–Chips alone: $7.00

GP100—$20.00
Maximum design versatility along with standard address decoding and buffering for S100 systems. Room for 32 uncommitted 16 pin IC's, 5 bus buffer & decoding chips, 1 DIP address select switch, a 5 volt regulator and more. High quality FR4 epoxy. All holes plated through. Reflowed solder circuitry.



WW100—$20.00
A wire wrap breadboard, similar to the GP100. Allows wire wrap of all sizes of sockets in any sizes of sockets in any combination. An extra regulator position for multiple voltage applications. Contact finger pads arranged for easy pin insertion.

Buffering Kit—$12.65
All the necessary components to bootstrap any Artec board into your system. Buffering I/O, DIP switch heat sinks and every support chip you need.

TO ORDER: Use your Mastercharge or BankAmericard. Or just send along a money order. We can accept only U.S. currency. Please include $3 handling on all orders. California residents add 6.0% sales tax.

FOR MORE INFORMATION: For more information about these or any of Artec's complete line of circuit boards or for either industrial or personal use, please call or write. A catalog will gladly be sent.

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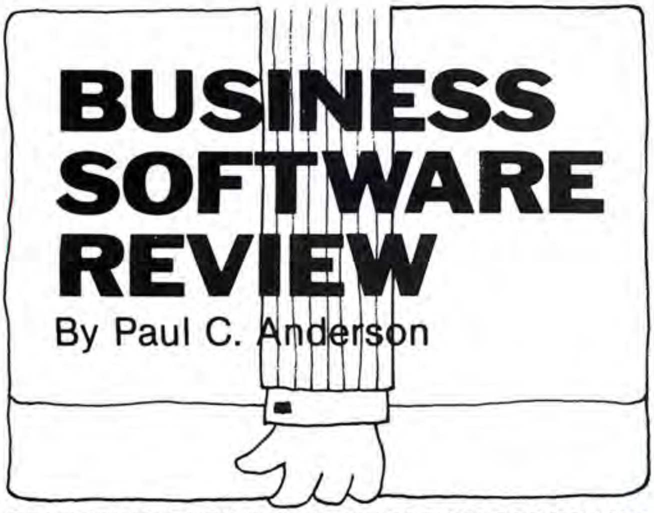


BUSINESS SOFTWARE REVIEW

By Paul C. Anderson

SELECTING BUSINESS APPLICATION PROGRAMS

The business owner who has decided to install a computer to handle his accounting is usually trying to get more accounting information about his business and get that information faster. He may also want greater accuracy in his records, and he may need a replacement for an obsolete accounting system that can no longer be expanded to serve his growing business.

After it has been decided that a computer is needed, the first step in the conversion is to find the right business applications programs, because the selection of the business programs usually determines which system software will be needed, and in turn, what computer equipment is required. If the owner chooses his business programs hastily, he may find himself worse off than before he decided to computerize, with a computer system that does not do what he expected. This state of affairs is known as a system failure, and horror stories about system failures are told wherever businessmen gather. System failures can best be avoided by a thoughtful plan, carefully executed. This article describes how the search for the right business program takes place.

SOURCES OF BUSINESS APPLICATION PROGRAMS

There are at least four different ways to acquire business programs. Each has advantages and disadvantages. For some users the best solution is to buy a complete turnkey computer system, including equipment, programs and financing. This solution seems quick and appeals to the businessman who doesn't want to get deeply involved in computers.

The disadvantages are that all of the business programs the owner needs may not be available from the vendor, and custom modifications to the vendor's programs may be expensive and cause installation delays. In addition, the customer feels locked in by the vendor because the vendor's computer equipment and system software are often non-standard, and therefore incompatible with other equipment and programs.

Some businessmen will consider hiring a programmer to develop custom business programs tailored to the owner's exact requirements. Many businessmen believe that the main disadvantage in custom programming is that it is usually expensive and often slow, and may turn out to be unsuccessful. Later modifications may be impossible if program documentation is poor, or the programmer is unavailable.

While businessmen are often encouraged to write their own business programs, most businessmen will not consider this approach because of the time required to learn a computer language and then write the programs. Most businessmen avoid this because they are looking for an accounting system, not a hobby.

For many businessmen, the right decision will be to look for acceptable business programs that have already been developed and build the computer system around them.

ASSISTANCE IN SELECTING BUSINESS PROGRAMS

Selecting the right business application program involves defining carefully what the user's requirements are, gathering information about available business programs, screening and evaluating the programs, and making the final selection (see Figure 1). Each of these matters will be considered, but first it is important for the business owner to decide whether he can do this work by himself.

Some businessmen will prefer to work alone, to save advisor's fees. If they have the knowledge, the time and the inclination to do so, they should go ahead, because they will learn a lot about their business and the new computer system in the process.

Most business owners will realize they need help, either

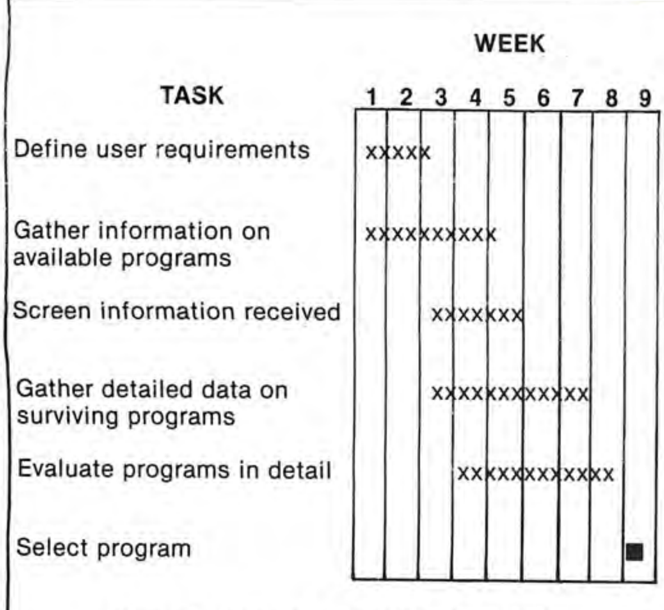


Figure 1. Program Selection Timetable

INCOME STATEMENT REPORT SPECIFICATIONS

1. Show current month, and year-to-date
2. Show amounts up to $9,999,999.99
3. Show whole dollars or pennies — at user's option
4. Show percentages of all other items to total sales
5. Calculate cost of sales using ending inventory
6. Compare current month this year versus current month last year; current year-to-date versus prior year-to-date; percentage and dollar variations between comparative amounts.
7. Generate statements for 9 different departments, and prepare a combined statement
8. Compare budget to actual; show percentage and dollar variations
9. Summarize general ledger sales expense detail into one report line
10. Suppress printing of zero-balance accounts
11. Show 6-digit alphanumeric account number

Figure 2. Output Report Specification

to define the company's requirements, or to screen and evaluate alternative programs. A good advisor will save the owner time and frustration, and help insure against selection errors. There are several places to get advice. Leads to qualified advisors can come from the business-man's CPA, local computer stores, computer hobby groups, computer magazines, even the yellow pages.

It may be practical to use different advisors on different phases of the project. The company's CPA is a logical person to help define the user's requirements. His knowledge of reporting requirements and his experience with a variety of accounting systems should allow him to suggest improvements to the present system, identify important system functions which will be needed in the future, and write specifications in enough detail so that screening and evaluation can be done quickly and economically. The owner who prepares his own specifications would be wise to have his CPA review them.

While carefully written specifications make the job of screening and evaluation easier, a consultant who is generally familiar with the field of microcomputers and available business application programs can help identify important programs which might escape the owner's attention.

He can also explain program features described in vendors' brochures and their significance to the user. He can help refine the user's specifications to incorporate desirable features discovered in the literature, or to exclude features which do not exist.

Finally, he can help select the rest of the computer system once the program has been chosen, install the new program, train personnel, develop required procedures and be a troubleshooter until the program meets the user's requirements.

The businessman should not plan to turn the program selection problem completely over to somebody else for solution. A good advisor will require the participation of the owner, and perhaps some of the company's key employees, to insure that the new program will perform successfully. Neglecting to involve those who will ultimately use the program greatly increases the risk of the dreaded system failure.

DEFINING USER REQUIREMENTS

The user defines his requirements so he will have a standard for evaluating available programs. Applications programming for microcomputers is not so advanced that a given program will do everything any user wants. Most programs are better understood by what they cannot do, so a user has to be sure of his needs in order to buy a program which will fill them.

By tradition, the definition of requirements begins with a careful study of the existing accounting system by a systems analyst. The analyst prepares a flowchart of the existing system and performs a careful analysis of input and output documents. Based upon his study, the systems analyst then prepares a flowchart of the new system, and determines what data must be created as input to the system, and what data is generated by the system, and how the data is processed by the system.

The business owner, however, is concerned principally with the characteristics of the output data (reports) since most of the system design decisions were made when the supplier was developing the business application program. The owner must reason through the problem backwards, from effect to cause. In order to get output information in a particular form having particular characteristics, it is necessary to begin with input data with particular characteristics, and process or manipulate that input data in a particular way.

Since the business application program has built-in limits as to the kind of input data it will accept and will process that data only in a pre-determined way, reporting the output data only within its limited capability, the owner's task in defining his requirements is to specify the form and characteristics the output data must have, and of the input data that will be available. He may require that the processing of data take place in a particular way (for instance, inventory values must be calculated using the average cost method), but most other system decisions will be beyond his control once he has selected the program to be purchased.

The output (report) specifications should be developed before input characteristics are specified. In developing these specifications, the owner, his advisor, and employees should study existing reports and examples of similar reports used by other businesses. They must think carefully about what is needed now, and in the future. When the substance of the needed input and output information has been established, its form can be decided.

The best way to do this is to prepare sample reports with sample data. The characteristics of these reports should be listed in a report specification in considerable detail, like the brief example shown (see Figure 2). In practice, the specifications would be quite extensive and detailed. Well-prepared report specifications require much thought and revision, but the effort will be repaid by a business program that fully meets the needs of the business.

One rule in writing specifications should be followed: specify only that which is necessary, not what is merely desirable. If this rule is ignored, the user may find that no available program meets his unnecessarily rigid specifications and that a perfectly adequate program is rejected.

GATHERING INFORMATION ON AVAILABLE PROGRAMS

Even before the specifications are established, the user can begin gathering information on available pro-

grams. This is often a lengthy process, so it should be started as early as possible. The user's goal is to find the best program for his needs while spending as little time as possible considering unsuitable programs. The best sources of business program vendors are microcomputer magazine ads, bingo cards and new product listings. Other sources are computer stores and computer shows. For those who live in areas of intense microcomputer activity such as the San Francisco Bay Area, Los Angeles and Orange Counties, and the Boston area, yellow page listings under Data Processing are useful. A phone call to a supplier of business programs will usually bring a brief description of the program.

The user should screen the initial information provided by suppliers against the established specifications. He should consider revisions of his specifications. as he examines vendor literature. He may find that additions need to be made, or that requirements must be expressed in greater detail. Certain characteristics may not really be essential. As the literature about each program is screened, the decision will be made to consider the program no further if it does not meet minimum requirements, or to ask the vendor for more detailed information about the program for further screening or a full evaluation.

BUSINESS PROGRAM EVALUATION

For the programs surviving the initial screening, the user should get a copy of the user's manual. It may be possible to borrow the manual from an existing user, or to buy an evaluation copy from the supplier on a money-back basis. A careful comparison of information in the manual with the user's specifications will show whether the program meets his minimum requirements, at least on paper. Naturally, this detailed screening will eliminate some programs, but a few programs should survive.

At this point, the evaluation procedure changes from one of rejecting unsuitable programs to one of choosing the best of the acceptable programs. Evaluation of program performance usually involves a demonstration of the program by the vendor, discussions with present users, and a test-run using the customer's own data. No irrevocable decision to purchase should be made until the user is satisfied the program works on his input, using his computer equipment if possible, and that the program does what the vendor claims it will do and will produce output that meets the user's requirements. In addition to the performance evaluation, there are a number of other matters that should be considered.

System software required: If the business application program is written in, for example, North Star BASIC and requires a CP/M operating system to run, the user must be prepared either to provide this capability, or to choose another business program compatible with his existing system.

Hardware required: If the business program requires, say, 48K of computer memory and a dual disk drive, the user must also be prepared to provide this equipment. It is not unusual for business programs to set requirements for printer capability (for example, top-of-form control and number of print positions) and disk capacity (for example, 256K of IBM-compatible storage, plus one drive for the operating system and another drive for the application disk). The business program or the operating system may also specify the kind of input terminal required.

Compatibility with other business programs: It is often difficult, or even impossible to integrate one supplier's general ledger program with another supplier's accounts receivable program. Unless a user's needs will be limited only to one program, or unless he is willing to take output data from one program and re-enter it manually into

another program, he should give strong consideration to buying integrated programs. This means buying all the business programs he needs as part of a package from one supplier, or being sure that other compatible business programs are, or will be, available.

Documentation: The user's manual or reference manual should explain clearly how to set up the program on the computer, how to run it, how to enter and correct data, and how to get output. It should be written clearly enough for the inexperienced machine operator to follow, but thoroughly enough for the owner or professional to understand what the program is doing and what it cannot do. Good documentation is essential, because poor documentation can lead to expensive, inconvenient phone calls to the supplier when a problem arises.

Vendor support and performance: Other users of the business program should be able to say how well the vendor supports his program. Vendor support means that the vendor guarantees the program meets the specifications shown in the user's manual. It also means that if the user finds an error in the program, the vendor will fix it. He will also notify the user of, and will correct, errors found by other users. When changes become necessary, it is good to know the vendor will be in business when he is needed.

Ease of learning and using the program: A program that is easy to learn and use has probably been well-designed and well-documented. Such features as operator prompts, error messages, and automatic defaults can spell the difference between programs where it is easy to make mistakes and waste time, and those where mistakes are prevented or easily corrected.

Ability to modify the program: This is a sensitive area for most vendors. In order to protect their proprietary rights to the program, it is increasingly common not to supply source code, which is necessary if the user wants to modify the program. Vendors justify this decision on the grounds that a user's modification may affect another part of the program in some unforeseen way, therefore if any modification is to be done, the vendor wants to do it himself. This attitude is usually justified, but it means the user depends on the vendor being available when modification is needed, so he must consider the vendor's track record and probability of staying in business. As a partial solution, many vendors create some limited ability for the user to choose certain program characteristics from among a small number of alternatives.

Restart and backup procedures: After somebody accidentally pulls the plug on the computer, or lays a magnetized screwdriver on top of a disk, it is too late to discover that no thought has been given to restart or backup requirements. The buyer should satisfy himself that the program is capable of conveniently recovering from any foreseeable catastrophe. He must be satisfied that it is practical to restart from any point in the process if a failure occurs, and that a restart does not take heroic efforts.

Production speed and efficiency: It should not take the operator longer to get data into the computer than it took to enter it into the old accounting system. There should not be long delays which keep the operator waiting while the computer does its internal work. It should be possible for the computer to work unattended while doing routine work which does not require operator input, such as sorting the month's journal entries, or printing month-end customer statements. Efficiency can best be evaluated by doing a test-run.

Cost: Computer programs are notoriously difficult to evaluate in terms of costs or savings because so much of the total cost of installing a program is intangible (such as diverting the owner and employees from other

tasks, retraining employees, and discarding obsolete forms), and so much of the benefit from the program is intangible (faster, more accurate information, improved employee morale, and favorable impression on customers).

While an effort should be made to budget tangible costs and identify benefits, ultimately the owner must assign a subjective value to the intangible benefits of the new program and decide for himself if they are worth the cost. When it comes to the price of a particular program, generally the least expensive program meeting the owner's total requirements is chosen. One way to judge the fairness of the program's price is to find out what similar programs cost and what a custom program would cost. Most program suppliers will not deliberately price themselves out of business.

PROGRAM INSTALLATION

Installation of the new program is not strictly part of the selection process, but requires as much care and attention as selection. After the new program has been ordered, the businessman needs to arrange for training employees. He may have to develop new procedures to gather and disseminate information required for, and produced by, the program. This may involve the design and printing of new forms, revising the filing system, and reallocating office work. The businessman should develop control procedures over input data to be sure it is entered correctly into the computer. He should arrange for conversion of old data to new history and master files required by the new program.

When the program is installed, he should probably run at least two cycles using both the old accounting system and the new program in parallel, in order to train personnel to use the program, to build confidence in it and to prove that the program is reliable. During the parallel runs, operators should practice system crashes and recoveries. Finally, he should schedule a post-installation review to determine that the new program meets his original requirements before abandoning the old system.

SUMMARY

Selecting business application programs is not easy if it is to be done well. Good programs are available from a rapidly growing number of sources. In defining the user's requirements and evaluating available business programs, most businessmen will want qualified professional advice. The effort used to select the best program may be wasted if installation of the program is not carefully planned and carried out.

Next month, general ledger programs for microcomputers will be covered. The report will set forth some of the desirable characteristics for any general ledger program, to help the interested reader make his selection. It will also evaluate one of the leading general ledger programs as it is tested in actual use. Later reports will cover available business applications programs for payroll, accounts receivable, accounts payable and inventory.☐

ABOUT THE AUTHOR

The author, Paul C. Anderson, is a partner in a San Francisco management consulting firm. Much of his recent work involves the installation of computer-based accounting and forecasting systems for smaller businesses. He has a bachelors degree in business administration from Golden Gate University, and is a CPA.

This column is now a regular feature of INTERFACE AGE. Its prime purpose is to review business applications in relationship to what they do. Software vendors who are interested in having their produce reviewed can contact Mr. Anderson by writing to: Paul C. Anderson, CPA, 20425 Almeda Street, Castro Valley, CA 94546.

THE MIND REVOLUTION

By Merl Miller

If you want to make serious study of artificial intelligence, what should you read? I will attempt to answer this question this month. What I am presenting here is by no means a complete list. Rather, I have tried to provide some feel for the literature in the field. Particular attention is given to cybernetics. I have stayed away from some of the more controversial subjects, such as learning theory. I'm always looking for good material, please write if you come across a good book or two.

The list is broken into three categories: Novice, Intermediate and Advanced. All categories, to some extent, relate to beginners. The Novice books are sufficiently simple that anyone should be able to read them. Intermediate assumes a little computer background — maybe at the college sophomore level. Advanced is everything else. But don't be put off by advanced books; even if you don't have the necessary mathematical background, you can still understand the basic concepts.

The parenthetical designation after each author is the publisher. A legend of the publishers is given at the end of this month's column.

NOVICE

This section even contains a work of fiction, R.U.R. The two best books in this section are R.U.R. and ROBOTS ON YOUR DOORSTEP.

R.U.R., 1973, Karel Capek (WS) — No discussion of robotics would be complete without this book. In Capek's play, robots destroy mankind and build a world of their own. Capek coined the word "robot".

ROBOTS ON YOUR DOORSTEP, 1978, Nels Winkless and Iben Browning (RP) — This is the best introduction to artificial intelligence I have ever read. It is an excellent starting place for any beginner.

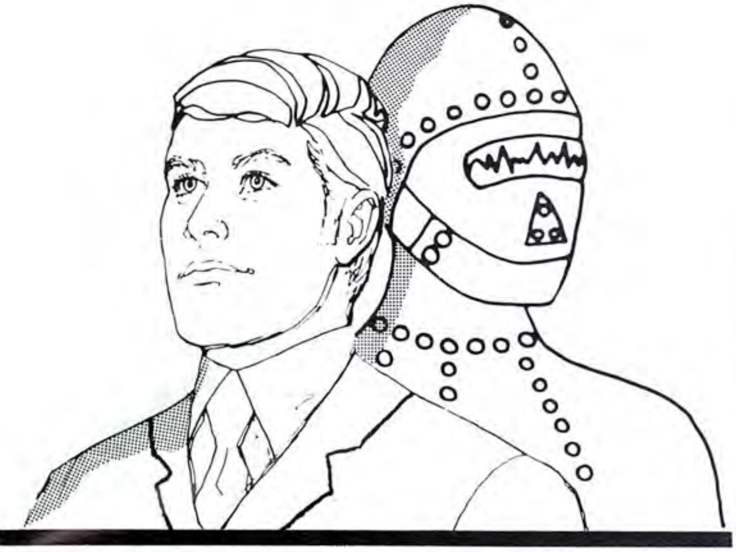
THE ROBOT BOOK, 1978, Robert Malone (JP) — This is an excellent introduction to robots and computers. It is worth reading just for the history. The book contains numerous drawings and photographs.

THE SEARCH FOR THE ROBOTS, 1967
Alfred J. Cote, Jr. (BB)

CYBERNETICS FOR THE MODERN MIND, 1971, Walter R. Fuchs (McM)—A delightful introductory book that covers all aspects of computer technology but focuses on information processing. Originally written in German.

THE MIND TOOL, 1976, N. Graham (WP)

INTRODUCTION TO COMPUTERS AND COMPUTER SCIENCE, 2nd edition, 1977, Richard C. Dorf (BF) — Chapter 18 of this excellent book contains Turing's



original and numerous comments about early pioneers. This book is worth buying for what is contained in this chapter.

INTERMEDIATE

If you remember my discussion of the Homeostat then you will remember W. Ross Ashby.

AN INTRODUCTION TO CYBERNETICS, 1956, W. Ross Ashby (Wiley) — from the Preface, "The basic ideas of cybernetics can be treated without reference to electronics and they are fundamentally simple." The book is in three parts: Part 1 is principles of mechanisms, such as stability, feedback, various forms of independence in the mechanism, how mechanisms are coupled; black box theory. Part 2 is methods from Part 1 to study information. Part 3 deals with how mechanism and information are used for regulation and control. The book makes considerable emphasis on biological systems.

THE METAPHORICAL BRAIN: AN INTRODUCTION TO CYBERNETICS AS ARTIFICIAL INTELLIGENCE AND BRAIN THEORY, 1972, Michael Arbib (WI) — The strongest parts of this excellent book are Chapters 4 and 6. Chapter 4 is a discussion of artificial intelligence and robotics. It starts with a discussion of perception, enlarges on such things as general systems theory, heuristics, scene analysis and ends with an integrated design of a robot. Chapter 6 is a detailed "layman's" discussion of memory and perception. It is loosely based on a paper Arbib wrote with Dr. Richard L. Didday, entitled "The Organization of Action-Oriented Memory for a Perceiving System" that was published in 1971 in the *Journal of Cybernetics*, 1, 3-18.

DESIGN FOR A BRAIN, 1954, W. Ross Ashby (CH)

BRAINS, MACHINES AND MATHEMATICS, 1964, Michael Arbib (MH)

THE THINKING COMPUTER: MIND INSIDE MATTER, 1976, B. Raphel (Freeman)

ADVANCED

Norbert Wiener was the "father" of cybernetics. He was one of a few real geniuses in the history of our civilization. Although his books are difficult, I believe most can wade through this one.

CYBERNETICS: OR CONTROL AND COMMUNICATION IN THE ANIMAL AND THE MACHINE, 2nd edition, Norbert Wiener, (MIT)

ARTIFICIAL INTELLIGENCE, 1977, P.H. Winston (AW)

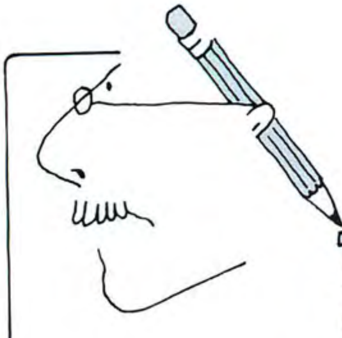
There are, of course, a lot of other books by good authors; these are my favorites; hope you will send me a list of yours.

These authors are always worth reading: Norbert Wiener, Meredith Turing, Michael Arbib, Marvin Minchy. W. Ross Ashby and Allan Turing.

I have steered clear of books about how-to-build-a-robot because I believe this is a subject for a later column.

Here is a list of publishers:

(AW) Addison-Wesley Publishing Co., Inc., Reading, MA 01867
(BB) Basic Books, Inc., 10 E. 53 St., New York, New York 10022
(BF) Boyd & Fraser Publishing Co., 3622 Sacramento St., San Francisco, CA 94118
(CH) Chapman & Hall Ltd., 11 New Fetter Lane, London, EC4P 4EE, England
(Freeman) W.H. Freeman & Co. Publishers, 660 Market St., San Francisco, CA 94104
(JP) Jove Publications, Inc., 757 Third Ave., New York, NY 10017
(MH) McGraw-Hill, Inc., 1221 Avenue of the Americas, New York, NY 10020
(McM) Macmillan, Inc., 866 Third Ave., New York, NY 10022
(MIT) The M.I.T. Press, Cambridge, MA 02139
(RP) Robotics Press, 30 N.W. 23rd Place, Portland, OR 97210
(WS) Washington Square Press, Pocket Books, 630 Fifth Ave., New York, NY 10020
(WP) West Publishing Co., 50 W. Kellogg Blvd., St. Paul, MN 55102
(Wiley) John Wiley & Sons, Inc., 605 Third Ave., New York, NY 10016
(WI) Wiley-Interscience, John Wiley & Sons, Inc., 605 Third Ave., New York, NY 10016 □



THE INVENTOR'S SKETCHPAD

By Roger Garrett
Northeastern Regional Editor

It is about time someone finally produced a true flat-screen display. I don't mean just a CRT with a flat front surface or a projection TV system. I mean a large flat screen not more than an inch thick; one that could be inexpensively mass produced, that would operate at normal computer voltages, and that could be made as large or as small as the application required.

There have been attempts at this, to be sure; but most have aimed at producing large (2") silicon disks with the whole screen etched on it. Now I have an alternative approach.

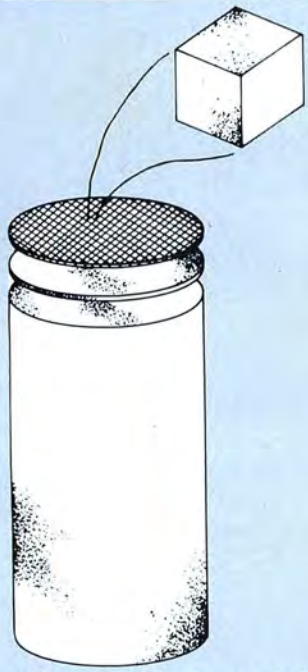


Figure 1. A solid piece of monocrystaline n-doped silicon is first grown utilizing readily available technology. This is then sliced into wafers and the wafers are cut into minute cubes about the size of chips used in light-emitting diodes (LEDs).

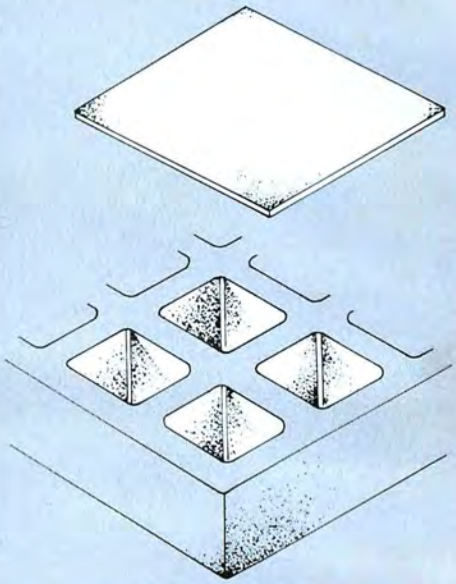
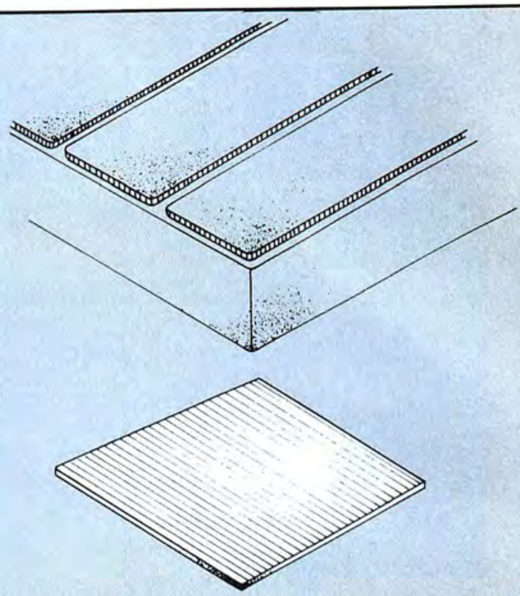
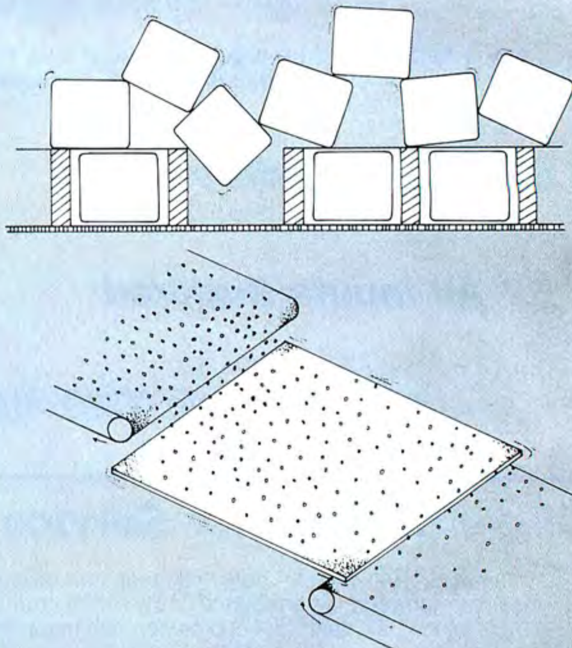


Figure 2. Meanwhile, a flat plate is formed of some strong, heat-resistant, non-conductive material. The plate resembles a perfboard in that it has an array of evenly spaced holes, but the plate is only slightly thicker than the silicon chips just produced and the holes are only slightly larger. The holes are also square rather than round. Typically the plate will contain an array of 1024 by 1024 holes (several plates might be butted edge to edge in the final setup to produce screens of any size).

 CIRCLE INQUIRY NO. 63

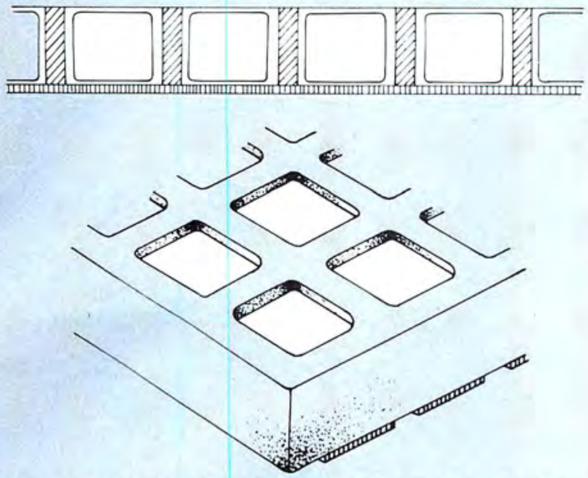


Figures 3a and 3b. Next, metal bands are bonded to one surface of the plate. Each band covers one row of holes and does not touch the adjacent bands. This provides x-axis addressing to the individual dots on the screen.

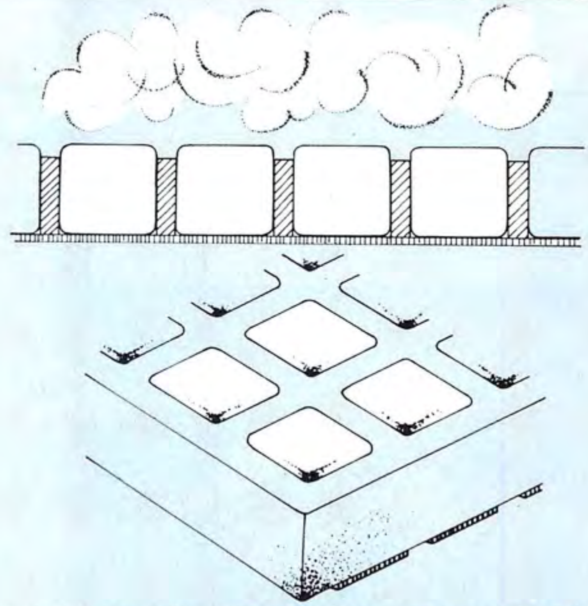


Figures 4a and 4b. Here we have turned the plate over so that the metal bands are on the underside so that each hole in the plate forms a small cup. This shows a cross-sectional view of the plate. The diagonally cross-hatched sections are the structures of the plate; the vertically cross-hatched section is the metal band. This is a view of a small section of one row of cups (holes).

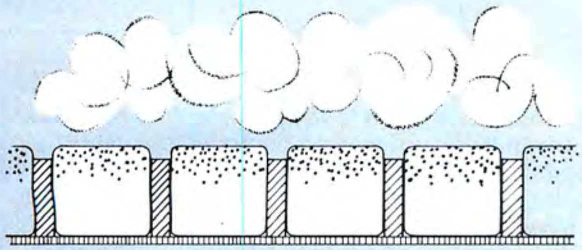
The next step in the process is to place one n-doped silicon cube into each cup in the plate. We could do it with a pair of fine-point tweezers and infinite patience, but there is a better way. We tilt the plate slightly, feed silicon cubes at the raised edge of the plate, and vibrate the plate. As the cubes move across the plate towards the lower edge, some of them will drop into the cups. The excess will fall off the lower edge, perhaps onto a conveyor belt to be recycled. After a sufficient period of time every cup will have a cube in it.

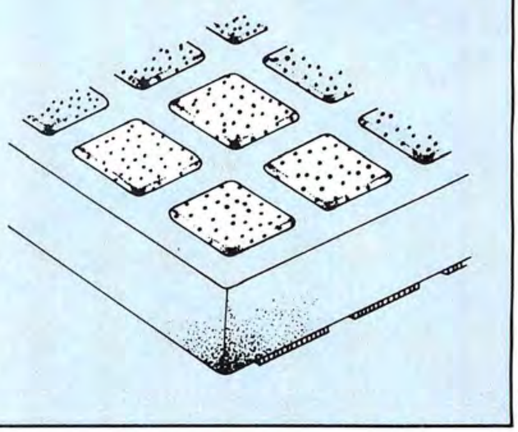


Figures 5a and 5b. The result of the vibration process is a plate with one silicon cube in each cup. Note, however, that the cubes do not completely fill each cup yet.

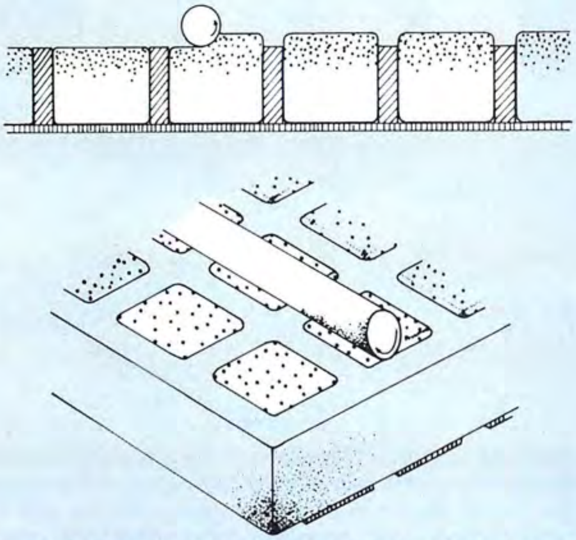


Figures 6a and 6b. The plate is now placed in a heat chamber along with n-doped silicon vapor, and the cubes grow, filling up the cups and bulging out the top. The crystal growth also provides good electrical contact with the metal bands.

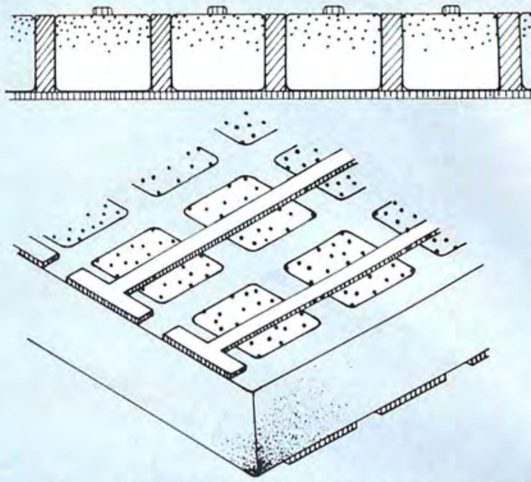




Figures 7a and 7b. We place the plate in a different kind of chamber, this time with p-doped silicon vapor, and by the diffusion method we cause the upper half of each cube to change from n-type to p-type. The p-type portion is shown in the diagram with dots. We now have a diode in each cup. Of course, we have used the proper types of dopant materials so that they are light-emitting diodes (LEDs).



Figures 8a and 8b. Since we don't want a bumpy surface on our flat screen display, we grind away the excess "bump" from each cup to produce a mirror-smooth surface.



Figures 9a and 9b. Next we bond metal bands to the top surface of the plate. These bands will be perpendicular to the bottom metal bands; i.e. the top bands lay across the columns of LEDs, the bottom bands cross the rows of LEDs. Also notice that the top bands are considerably thinner and that a substantial portion of each LED is exposed. This, obviously, is so that the light generated by each LED can be seen. An alternative to the thin metal bands might be conductive clear plastic, but that would probably raise the price of the plate substantially.

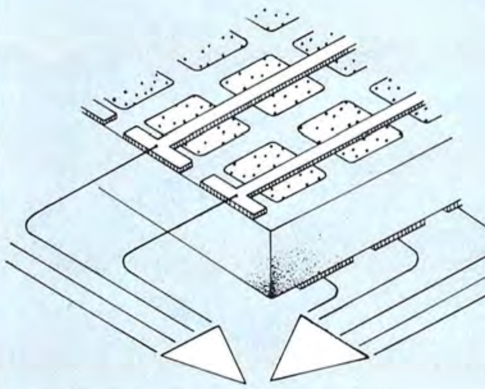


Figure 10. All that remains is to make electrical connections to the individual rows and columns, connect that to appropriate addressing circuitry (a few simple counting, clocking, and address decoding chips will do nicely) and we have a flat screen visual display unit. Any dot (LED) on the screen can be turned on simply by addressing it by its row/column number. In the drawing above the dot at row 1 column 0 has been addressed (i.e. the metal band of row 1 has been connected to ground and the band of column 0 is connected to +5 volts) so the dot is glowing. Obviously, all rows/columns must be sequentially and quickly addressed to have a steady display over the entire screen but this is quite simple.

 CIRCLE INQUIRY NO. 52

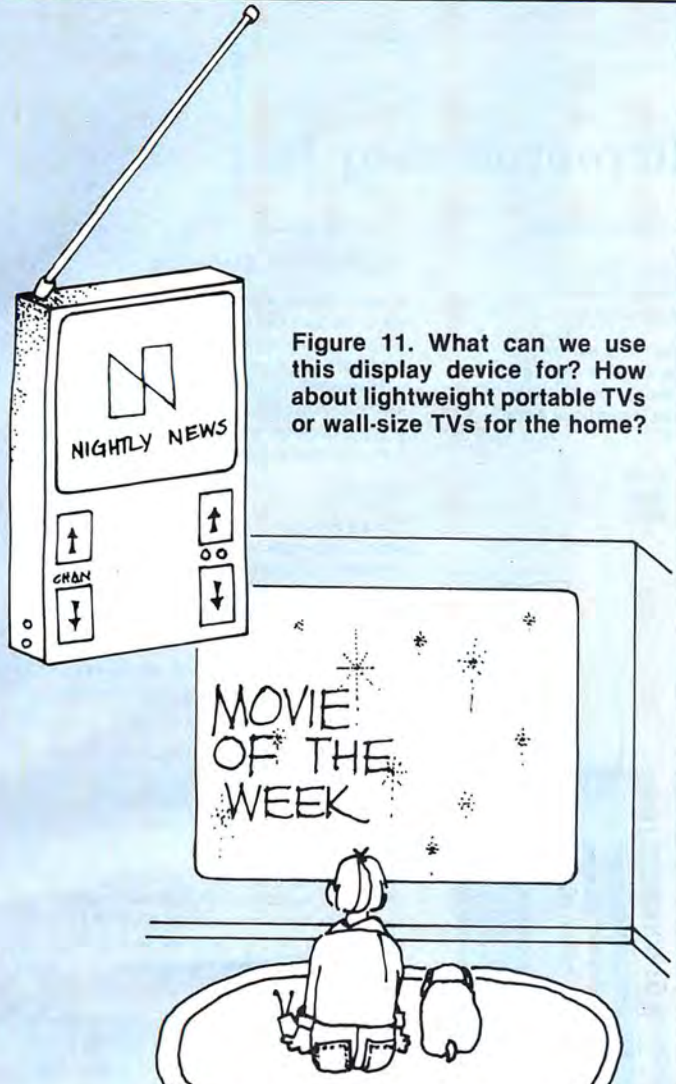


Figure 11. What can we use this display device for? How about lightweight portable TVs or wall-size TVs for the home?

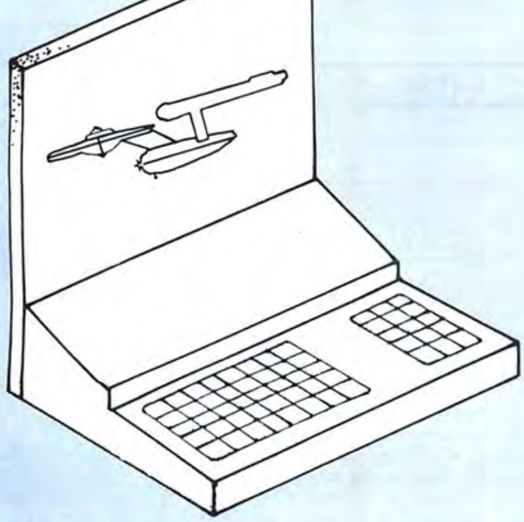


Figure 12. And of course there are the multitude of applications in the computer field. The cost of a full system should be considerably less without the tube and special power supply needed for conventional CRT type displays.

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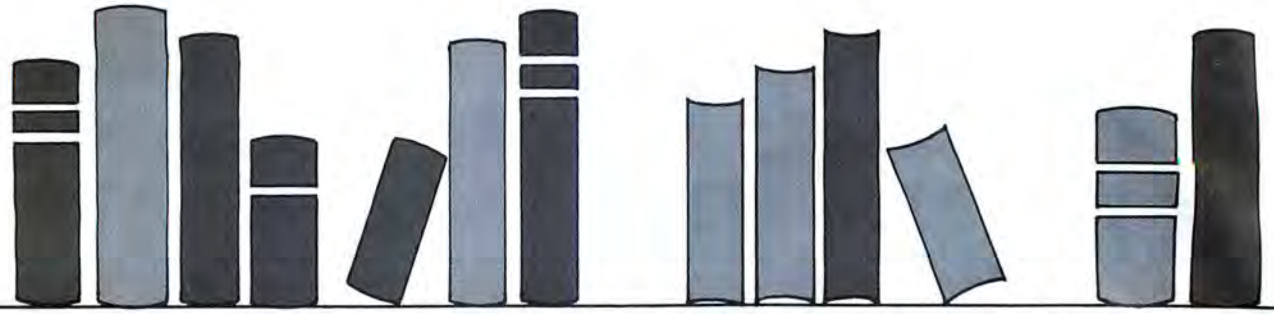

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Following the author's name is an abbreviation for the publishing company and the price. A guide to the publishers and their addresses is printed at the end of the list.

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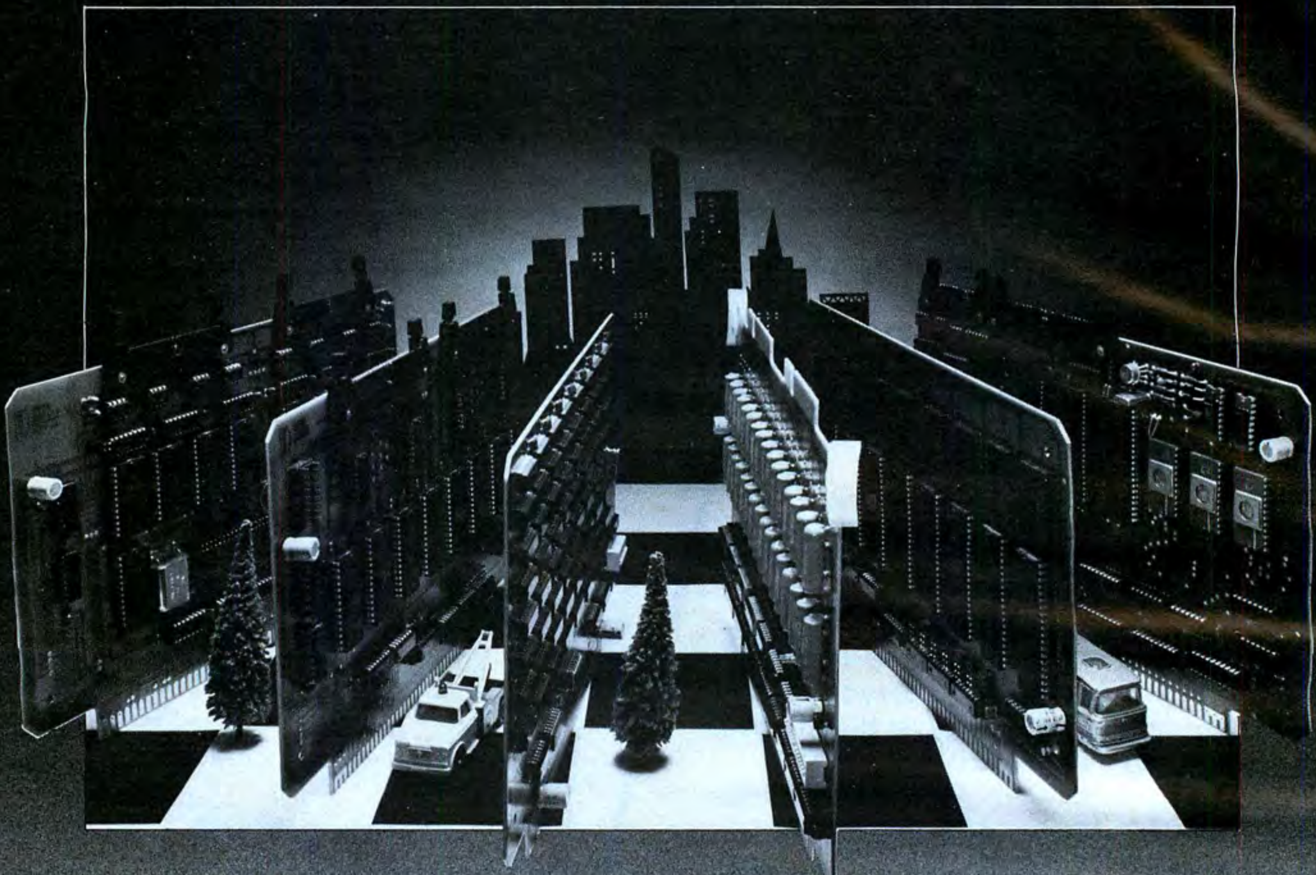

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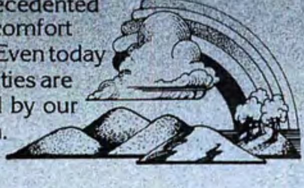

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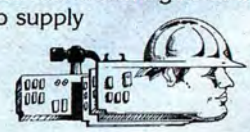

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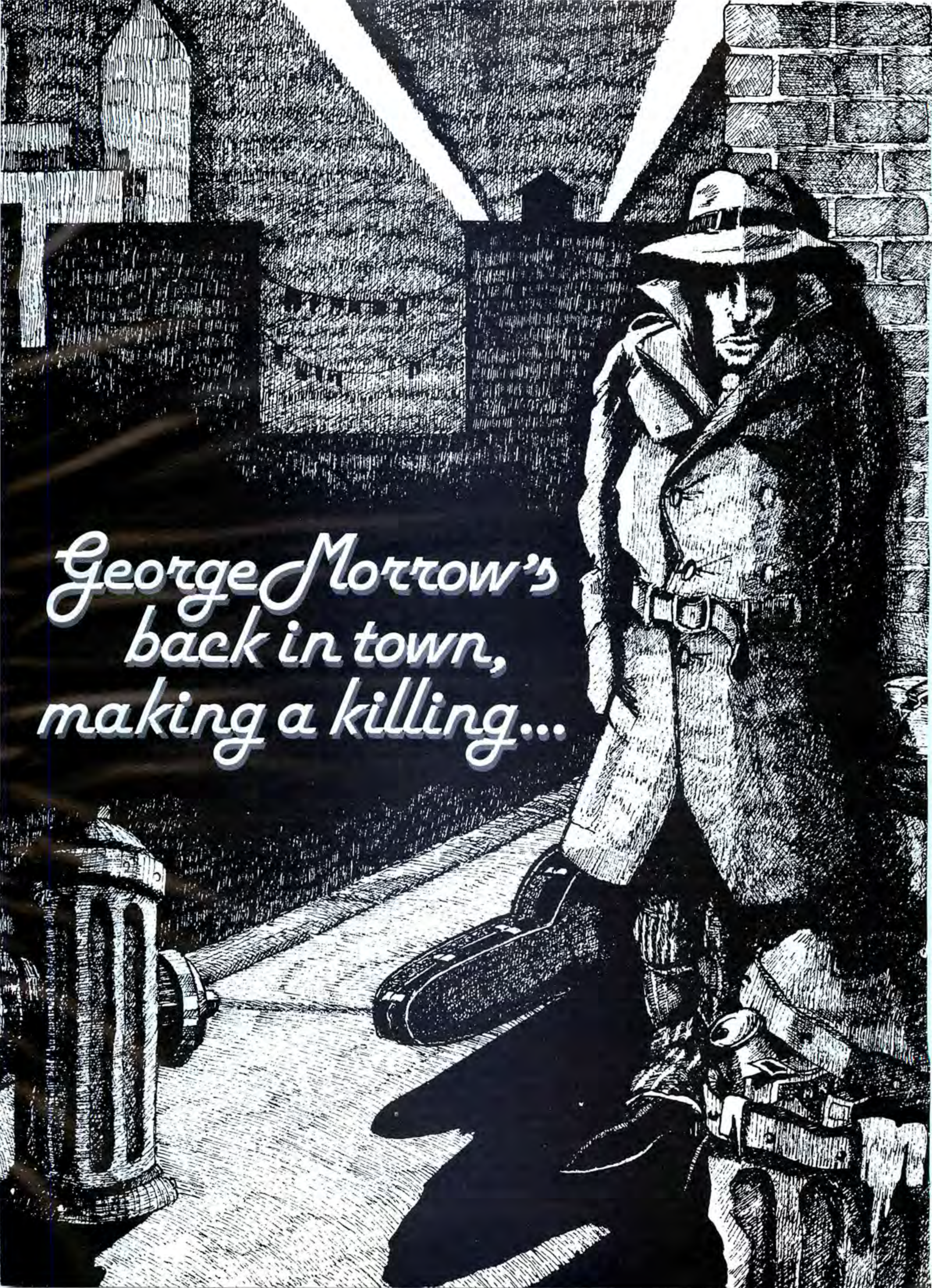
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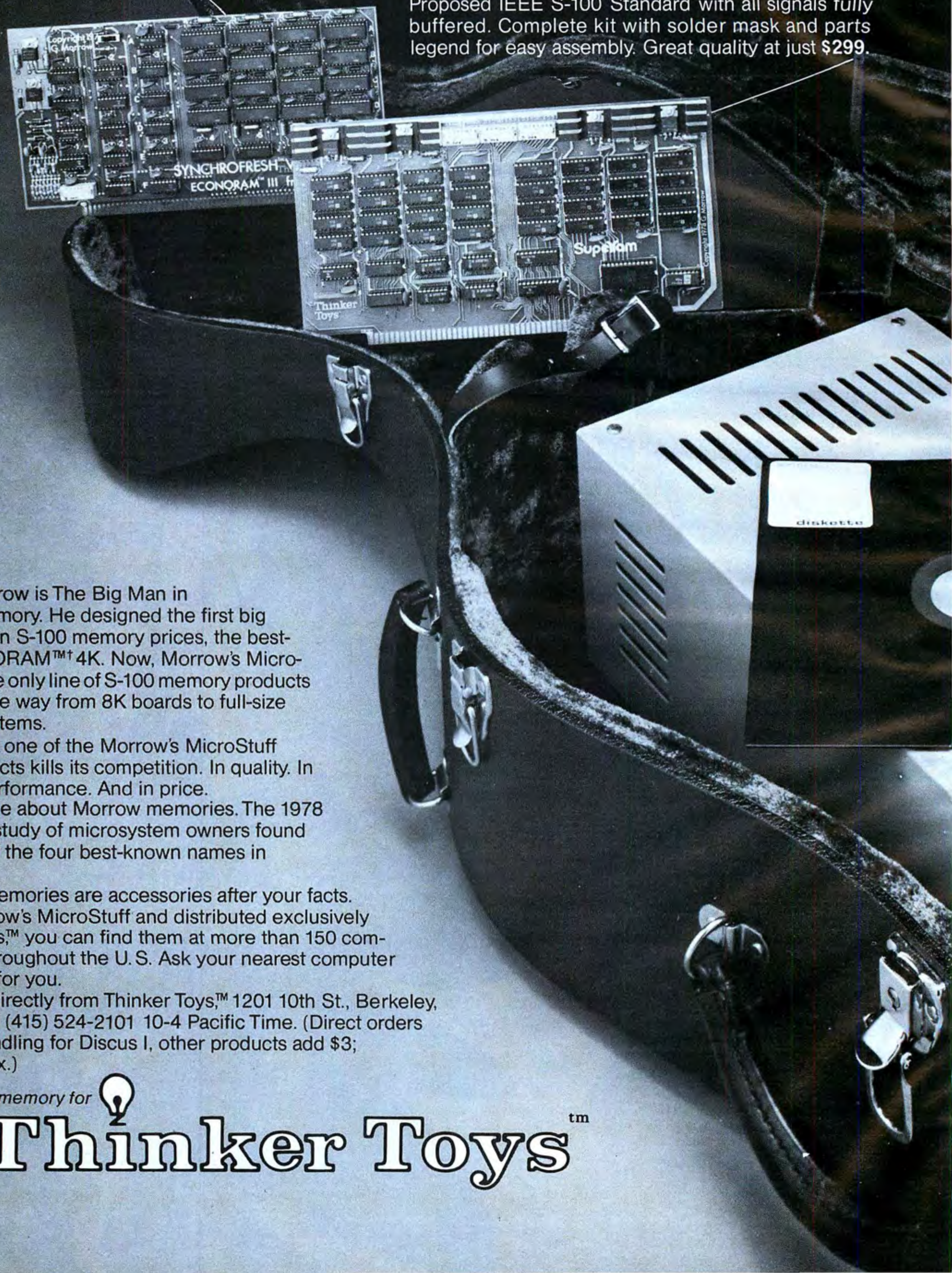

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CIRCLE INQUIRY NO. 58

Wordprocessing:

A Major Factor in Small Business Computing?

By Carl Warren, Senior Editor

The art of wordprocessing has from the beginning of recorded time been the technique used to prepare words to be read. Wordprocessing as we know it today brings to mind computers that provide an operator with the ability to quickly add, move, delete, or rearrange words before they are committed to paper.

Before mechanized devices, wordprocessing was done by hand. The process consisted of writing the words on paper, then by use of a pencil, scissors and glue rearranging them into the desired sequence. Once this was accomplished, the entire piece of writing was rewritten into a legible, useful form to be duplicated and disseminated. A long tedious process that costs hours of manpower and ultimately dollars.

This lengthy process is performed every day by thousands of secretaries and authors who are preparing the written word. An unnecessary evil when consideration is given to modern day technology in the word processing field.

Since written communication plays a major role in the operation of business, it seems that streamlining the handling of words would benefit business in general. Obviously there is a great deal of truth in that statement and consequently it has prompted several manufacturers to enter the world of wordprocessing.

HOW WORDPROCESSORS WORK

The word wordprocessor has two meanings. First it means the building and editing of text to the desired sequence. Secondly, it is the processing of this edited text and outputting it to a printer device.

BIHARI REFUGEE CAMP STORY

Dacca, Bangladesh

(Narration time - 2:30)

(Final edit - 3:15)

The story:

This is about one family's struggle for survival in the Bihari Refugee Camp. Stan is seen on camera. Most of the story takes place in one location. Stan is with the family in front of their hut. This "set-up" of the family and BG is critical. It should reveal their poverty. It should not look "staged", and should allow Stan to be comfortable with the family.

SCENE 1 Open on CU of Stan.	Stan: (SYNC) Statistics tell us that there are over 15 million refugees in our world today.
Camera PULLS OUT to reveal the Mohammed Taher family in BG, sitting outside of their hut. The mother is cooking over open charcoal fire.	Stan: (VO) But statistics alone can be misleading. Though they can help us see the immensity of a problem...they sometimes blind us from seeing its humanity.

Figure 1.

Modern wordprocessors perform these functions by using a television type display terminal — CRT — which provides the user with the power of an electronic typewriter. Since the copy is displayed on a screen, special commands called editing commands are provided, making it possible to rearrange the words, and make necessary changes at will.

Once this editing function is performed to the operator's satisfaction, the system then uses its processing capabilities to transfer the text to the printer in a specified format.

The wordprocessing systems are able to perform these functions by using microprocessor power to make the typewriter intelligent. The intelligence comes from special programs called editors and wordprocessors. Each of these programs provides the necessary functions to the system and makes the operator's job easy.

Originally, text editors were associated with the development of computer programs. The editor allowed text to be entered in a specified manner to work with a program, called an assembler, that produced computer code. As the microcomputer industry has matured, these editors have also, and now provide full text editing capabilities.

INFO 2000
CORPORATION

October 5, 1978

Mr. Joe Q. Customer
1234 Shady Lane
El Centro, California 90123

Dear Mr. Customer:

Thank you for your recent letter inquiring about the INFO 2000 Business System and its TEXT 2000 word processing software.

In response to your question about leasing the Business System, a variety of lease plans are available to qualified lessees from various third-party leasing companies in the Greater Los Angeles area. Typical would be a five-year full-equity lease with a ten percent buyout at the end of the lease term. Average rates for such a plan are about $27.50 per thousand per month, so that the monthly lease payment on a $11,000 Business System configuration would be roughly $310.

Do not hesitate to write or call if you have further questions. Thank you for your interest in the INFO 2000 Business System.

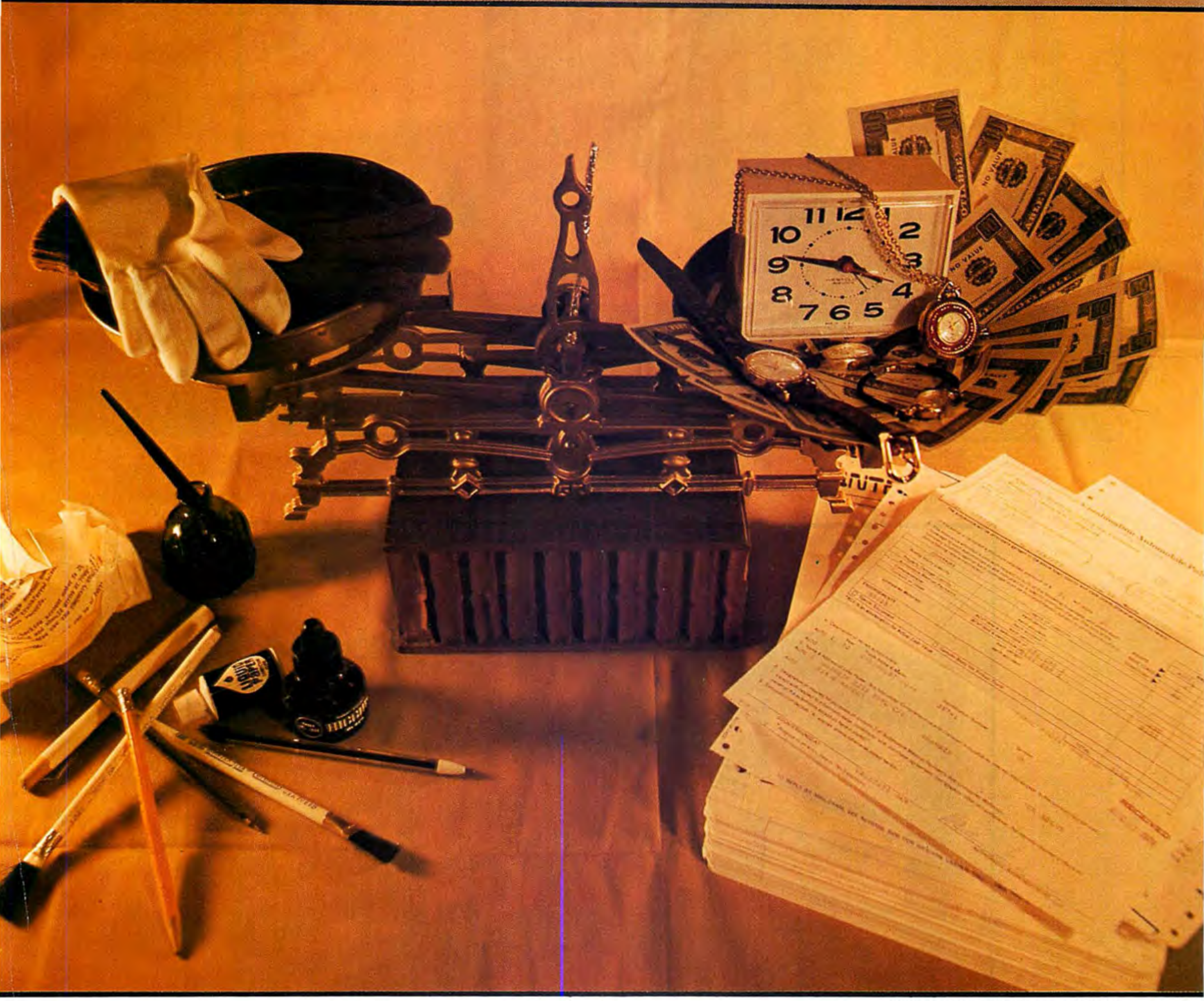
Very truly yours,

INFO 2000 CORPORATION

Michael D. Busch
Vice President and General Manager

Figure 2.

Manpower vs. Wordprocessor



PHOTOGRAPH BY SHELLEY WRIGHT

These text handling capabilities now allow for the handling of upper and lower case letters, the entering of formatting directives to be used by the wordprocessing program, the moving of blocks of words such as paragraphs to new locations and, most importantly, providing for the ability of redundancy in the processing of the same text.

WHERE WORDPROCESSOR BEST FITS IN

Wordprocessors, like any computer-oriented system, find their best usage in business or functions that require the generation of a large amount of text. Ideally the system performs the best and is most cost effective where the text requires a great deal of revision such as the preparation of law briefs or the writing of scripts (Figure 1).

Another advantage of using wordprocessors in the business environment is the preparation of letters that can be made up from "boiler plates" — prewritten paragraphs. Most interactive wordprocessors using the facilities of naming files for specific purposes provide this function and merely require the operator to insert the address and recepient's name, then call the desired paragraphs in any order required. Figure 2 is an example of this letter writing function using the INFO 2000 TEXT 2000 wordprocessing system.

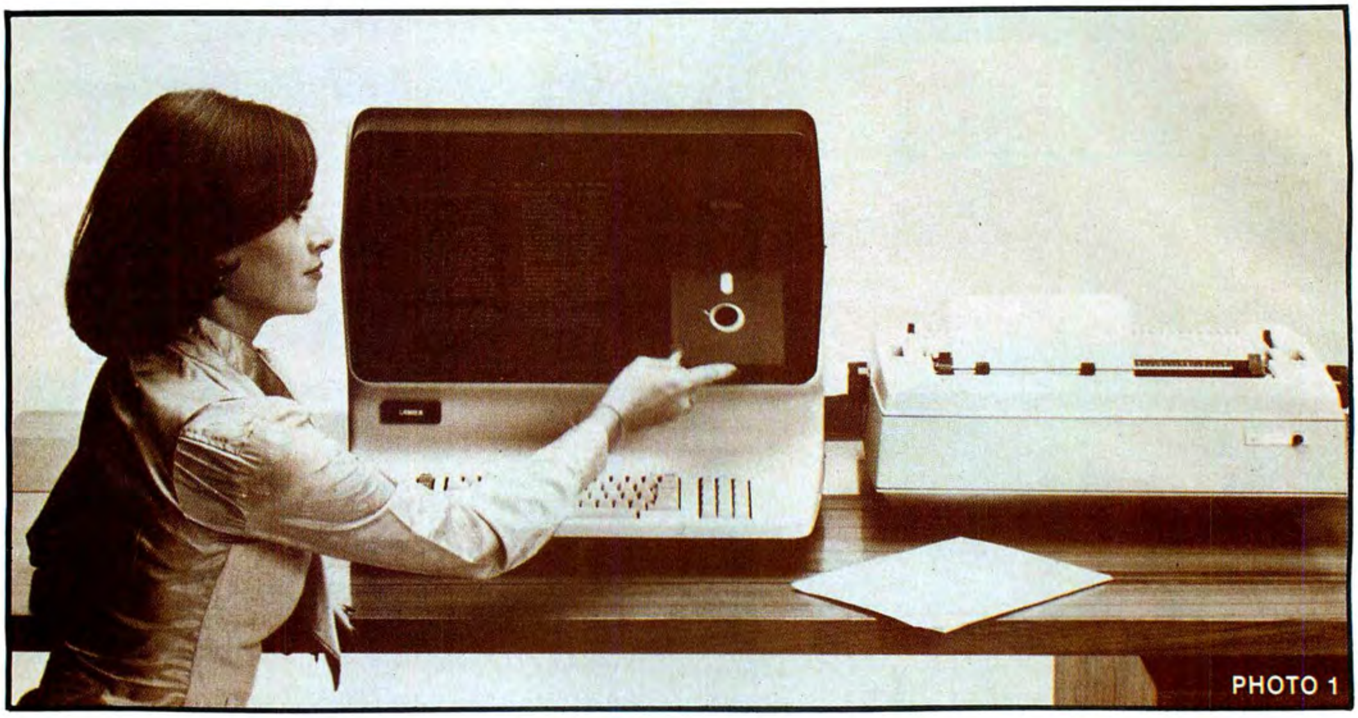


PHOTO 1

PHOTO 2

PHOTO 3

THE IMPORTANCE OF THE HARDWARE

Since modern day wordprocessing is built around computers, hardware considerations are an important aspect in choosing a system. The hardware does to a large degree determine how well the system will meet a specific need in any given office. Cost and reliability are the two most important factors, along with maintenance of the system.

To help make value judgments regarding the choice of hardware, it is important to decide exactly what is to be done in the actual business environment.

If the system is to be used for both wordprocessing and general business, a system that provides these capabilities must be considered. This means that sufficient storage capabilities must exist for both text and the business accounts. The printer must be given particular attention, since in most cases the copy generated by the wordprocessor on this printer will be the copy sent to customers or used in promotion material. With current costs, approximately $1,500 to $4,000 can be spent on the printer alone.

Another consideration that is important is the amount of information that will be stored. This will determine the necessary size of the storage media, 5.25 inch diskettes versus 8 inch diskettes. The direct cost of the system in relationship to maintenance costs, supply costs and the amount of time saved by using the system are also vital considerations.

In many cases existing equipment being used for business applications can be used for wordprocessing by purchasing the necessary software and training the operators. For example, businesses that have elected to use the TRS-80, or contemplating doing so, will find the Electric Pencil™ is available for $99.95 from Michael Shrayer Software Inc. This wordprocessing system has found usage in over 60 different system configurations and has withstood the test of time for reliability.

Considerations such as the above are important so that total satisfaction is gained from a chosen system.

THE PROVIDERS OF WORDPROCESSORS

During the past two years and even months, several hardware and software manufacturers have entered the wordprocessing field. Probably the most visible wordprocessing system to the buying public is the LANIER "NO PROBLEM™" typing system.

The "NO PROBLEM" typing system (Photo 1) is a stand-alone video display text editor that can be customized for special applications. The system allows the operator to format both horizontal and vertical page sizes of up to 254 characters wide or 99 lines long with the ability to rebalance the pages.

The "NO PROBLEM" uses mini-diskettes for text storage and a high speed impact printer that prints in both directions. Lanier also provides a complete wordprocessing course on cassette to cut down on training time, Photo 2.

Lanier has added financial capabilities to the system with the addition of a "SMART DISK™", thus making the "NO PROBLEM" system a complete business system. The Lanier system sells in the $14,000-plus range. Further information can be obtained by contacting: Mark Johnson, LANIER, 1700 Chantilly Drive N.E., Atlanta, Georgia 30324 or calling (800) 241-1706.

PHOTO 4

One of the newest entrants into the wordprocessing field is INFO 2000. The system offered by them is a dual purpose system consisting of a Perkin Elmer terminal (Photo 3) that provides a 24x80 display of extremely legible characters, two PerSci 277 disk drives, the Diablo HyType II daisywheel printer for wordprocessing and a Z-80 based computer system, Photo 4. This system sells in the $12 to $13 thousand range.

The wordprocessing software is TEXT 2000™, which provides full-screen text editing functions and uses the numeric keypad as a cursor function keypad. TEXT 2000 uses easy single letter commands to find, replace, insert, delete, save, typeover, page, word, quit or move text to any desired area in the body copy.

Additional information on the INFO 2000 system can be obtained by writing or calling Michael D. Busch, INFO 2000 Corporation, 20620 South Leapwood Avenue, Carson, California 90746, phone (213) 532-1702.

Space Byte Computer Corporation of Los Angeles recently added the ASSISTANT SECRETARY™ wordprocessing system to its business system. The Space Byte system uses a Hazeltine printer, dual iCOM disks, Diablo printer and an 8085 based computer system. The system is a complete business system selling in the $10 to $11 thousand range depending on the options.

The ASSISTANT SECRETARY provides on-screen editing capabilities with standard text editing features of: insert, delete, search, duplicate, indent and bold face, to name a few. The Space Byte system, Photo 5, is designed with the user in mind and utilizes user prompting to minimize operator error.

Additional information on the Space Byte system can be obtained by contacting Norm Baker, Space Byte Computer Corporation, 6464 Sunset Boulevard, Suite 530, Los Angeles, CA 90028, phone (213) 468-8080.

Other providers of wordprocessing systems include:

WANG LABORATORIES with their MODEL III™ system selling in the $10,000 range. This system offers the standard features of most wordprocessors. Additional information about the MODEL III is available by contacting: Sheryl Garelick, WANG Laboratories, One Industrial Ave., Lowell, MA 01851, phone (617) 851-4111, Ext. 2385.

Basic Four Corporation, with their DATAWORD™ wordprocessing and data processing system (Photo 6). This system, priced in the $12 thousand range, provides data security and high level interactivity which has been the hallmark of Basic Four computer systems. Interested parties should contact: Basic Four Corporation, P.O. Box C-11921, Santa Ana, CA 92711, Phone (714) 731-5100.

Users looking for text processing software to run on existing machines will want to contact the following companies:

Jim Reynolds, Andromeda System Inc., 14701 Arminta Street, Unit J, Panorama City, CA 91402, phone (213) 781-6000. Andromeda has available for $200 the VEDIT™, a text editing program for the Digital Equipment Corporation PDP-11 minicomputer series. This editing system supports the Lear Siegler ADM-3A and Hazeltine 1500 series terminals.

Autoscribe™, offered by Microsource, is for Z-80/8080 based machines. Autoscribe supports Soroc and Hazeltine terminals and utilizes the North Star DOS. No price information is currently available, but information can be obtained from: MicroAge Wholesale, 1425 W. 12th Place, Tempe, AZ 85281, phone (602) 967-1421.

Michael Shrayer Software Inc., 1253 Vista Superba Drive, Glendale, CA 91205, phone (213) 956-1593, offers the Electric Pencil, designed for Z-80/8080 systems with video display boards.

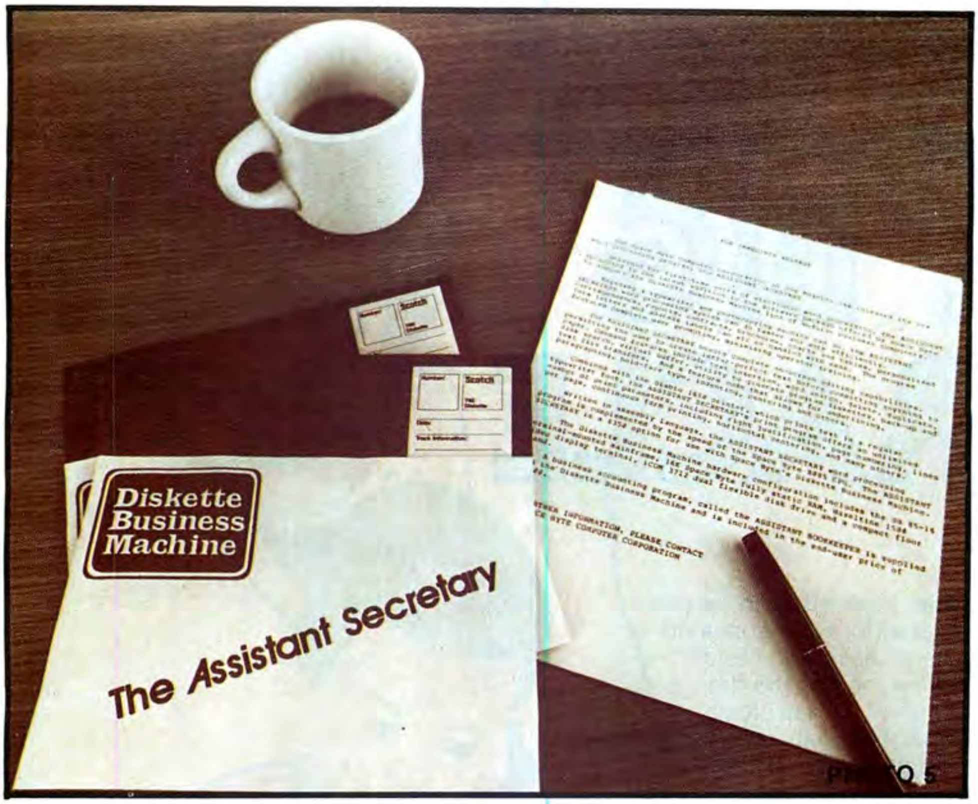
COMPAL Computer Systems, 12321 Ventura Blvd., Studio City, CA 91200, phone (213) 760-3345. COMPAL provides the WP56-D/M wordprocessing system.

Cromemco Inc., 280 Bernardo Ave., Mountain View, CA 94043, phone (415) 964-7400. WPS-S/WPS-L wordprocessing systems for Z-80 and 8080 systems.

Diaspar Data Systems, P.O. Box 888, San Juan Capistrano, CA 92675. Diaspar offers the DTEXT™ wordprocessing system for Z-80 and 8080 systems.

Digital Research, P.O. Box 579, Pacific Grove, CA 93950, phone (408) 649-3896. TEX™ is a text formatter for systems using CP/M.

Computer Services of Encinitas, 341 Willowspring Drive, Encinitas, CA 92024, offers a wordprocessing system for the North Star Micro Disk for $50.



PRO-TYPE™ a wordprocessor for the North Star disk or Meca tape system is available from: Interactive Microware, Inc., 116 S. Pugh St., State College, Pennsylvania 16801, phone (814) 238-7711, for $75 including media and documentation.

MVT MICROCOMPUTER SYSTEMS, INC., 9241 Reseda Blvd., Suite 203, Northridge, CA 91324, phone (213) 349-9076, has available MVT-WORDFLOW™ designed around the S-100 bus type machines using the FAMOS™ multi-tasking DOS. This system provides multi-user capabilities for both word and data processing.

uEDIT™, a full screen text editor for Meca tape systems, is available from MICRO INFORMATION SYSTEMS, 158 Valparaiso, San Francisco, CA, phone (415) 441-4597.

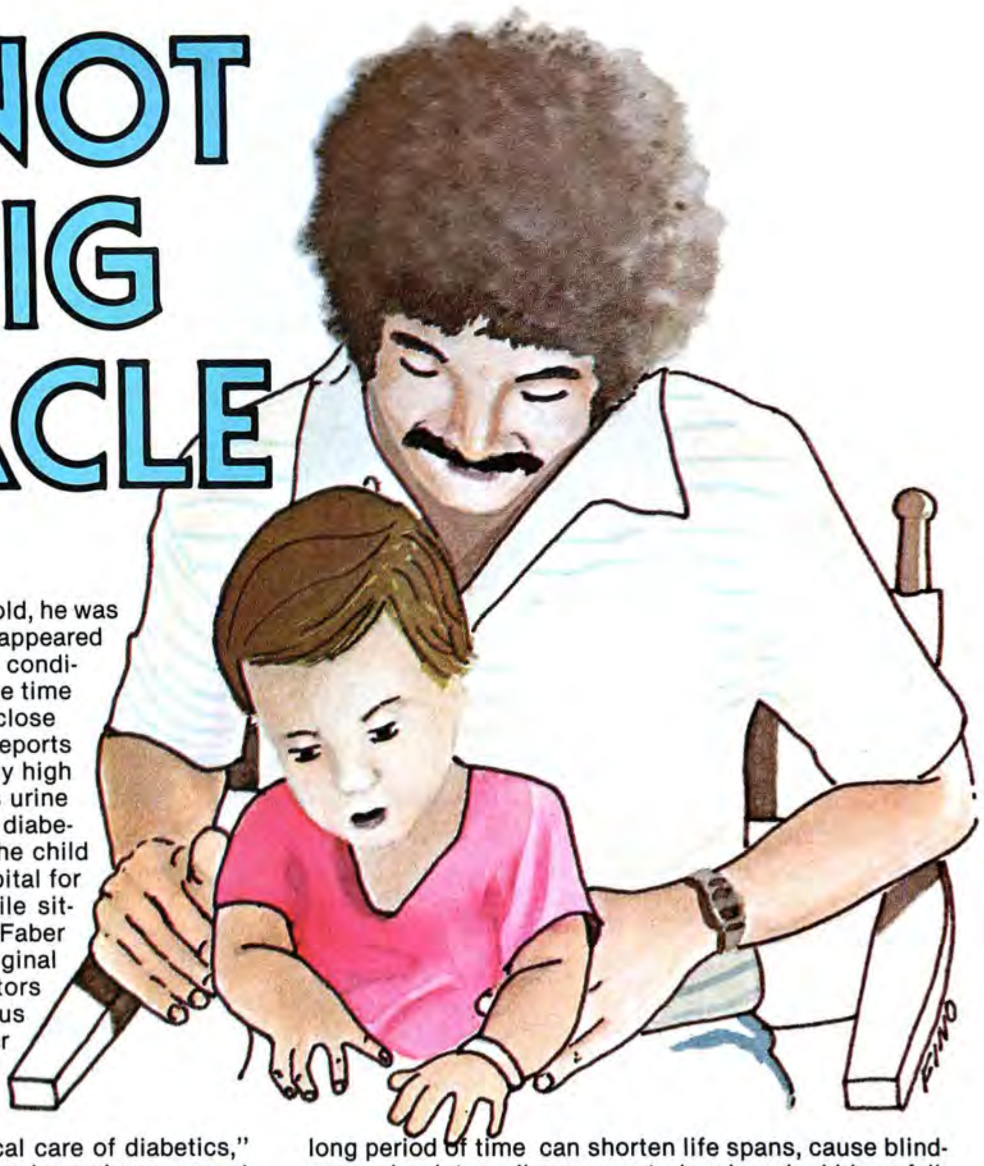
6800 system users will want to contact: Software Dynamics, 2111 W. Crescent, Suite G, Anaheim, CA 92801, phone (714) 635-4760 for their EDIT™ wordprocessing software, or Technical Systems Consultants, Inc., P.O. Box 2574, W. Lafayette, IN 47906, phone (317) 423-5465. TSC provides wordprocessing packages for the 6800 and 8080 machines.

THE COMING OF AGE

With 1978 rapidly coming to a close, the possibilities of microcomputer business systems are just getting started. It has been estimated that the small business computer market in 1979 will have the possibility of being in the $3 billion range for wordprocessing systems alone.

Micro business systems are coming of age, and with the utilization of wordprocessing will begin to find their way into more and more businesses. □

IT'S NOT A BIG MIRACLE



When Ryan Faber was 13 months old, he was admitted to the hospital for what appeared to be a normal virule disease. His condition worsened, however, and by the time his ailment was identified he was close to going into a coma. Then lab reports came back revealing an extremely high level of sugar and keytones in his urine and blood. "This was a red flag for diabetes," recalls Dr. Clifford Rubin. The child was saved, but he was in the hospital for eight days. During that time, while sitting at his son's bedside, Steven Faber developed a remarkable and original computer program that monitors Ryan's blood sugar level and thus helps maintain better control over his disease. How remarkable and original is it?

"Using the computer in this way is a new aspect in the medical care of diabetics," states Dr. Rubin, "and other doctors have shown a great deal of interest in following this up in the future. But it doesn't have any meaning unless it benefits many cases and many people. It could eventually be a routine type of thing in the next ten years."

There's nothing routine, however, about diabetes, an inherited disease that prevents the body from using sugar by blocking the production of insulin in the pancreas. Insulin is what enables blood sugar (glucose) to enter the cells. When glucose can't enter the cells, it builds up in the bloodstream.

But since the cells are still not receiving sugar, the body turns to stored sugar (clycogen) in the liver and muscle. When the level of glycogen is low, energy is then derived from the breakdown of body fat. Some of this fat is turned into toxins called keytones, which also build up in the blood. If too much sugar and keytones are in the blood, the individual can become extremely ill and may require hospitalization. This is what happened to Ryan.

Now 23 months old, Ryan takes daily injections of insulin to keep his blood sugar level under control. But contrary to popular belief, insulin is not a cure for diabetes. In fact, its use is dangerous in and of itself.

Insulin must be administered extremely carefully in relation to the diabetic's food intake and exercise. If too much food is eaten, the insulin is quickly used up and the blood sugar and keytone levels rise. While this abnormal blood chemistry presents an immediate danger, even moderate excesses of sugar in the blood, over a long period of time can shorten life spans, cause blindness, circulatory diseases, arteriosclerosis, kidney failure and other disorders.

On the other hand, if not enough food is eaten or if too much exercise is had, the insulin will deplete the available sugar and unless more sugar is administered, an insulin reaction can occur, causing anything from dizziness to a coma and convulsions.

So while he's too young to realize it now, Ryan Faber is in a very precarious position. This is why it's so important to accurately monitor the level of blood sugar and the amount of insulin he has in his system at all times.

And that's exactly what the computer does. It not only charts Ryan's urine sugar by the hour on a daily basis and produces an average for the week, but it charts the two types of insulin (regular, or short-term and longer-acting NPH) he uses on the same graph so that the amount of insulin in the blood can be compared to the amount of urine sugar. When the insulin level is high, the urine sugar should be low.

Why test urine sugar? Basically because urine sugar represents the blood condition of an hour earlier. Normal blood sugar is 80-120 mg. per 100 milliliters. But if the level goes over 140 mg%, sugar spills out in the urine. By calculating the concentration of sugar in the urine, the degree of excess sugar in the blood can be determined. This is measured on the Clinitest scale, which goes from zero (negative, or no sugar) to five.

The significance of doing this for a diabetic can be explained very simply. It's like watching a dam and trying to determine how much water is on the other side. If

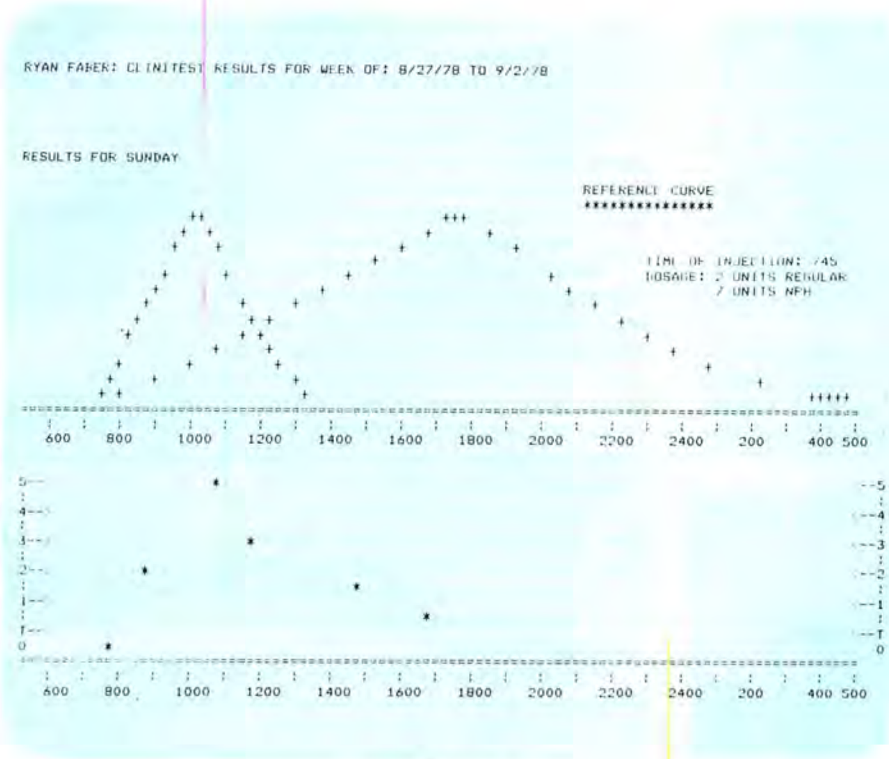


Figure 1.

SAMPLE RUN

```
READY
RUN

STARTING DATE FOR RUN? 8/27/78

CLOSING DATE FOR RUN? 9/2/78

DATA FOR SUNDAY

TIME OF INJECTION? 745

DOSAGE (REGULAR,NPH)? 2,7
 600 ?
 700 ?
 800 ? 0
 900 ? 2
 1000 ?
 1100 ? 5
 1200 ? 3
 1300 ?
 1400 ?
 1500 ? 1.5
 1600 ?
 1700 ? .5
 1800 ?
 1900 ?
 2000 ?
 2100 ?
 2200 ?
 2300 ?
 2400 ?
 100 ?
 200 ?
 300 ?
 400 ?
 500 ?
```

there's no water coming over the dam, the reservoir could be almost full or almost empty. Similarly, when there's no sugar in a diabetic's urine, he could be almost normal or have so little sugar in his blood that he's setting himself up for an insulin reaction. Conversely, while a constant stream of water over the top of the dam indicates that the water level is too high, a constant stream of sugar in a diabetic's urine indicates that his blood sugar level is too high.

However, if there were a tiny trickle of water coming over the top of the dam, it would indicate that the water level was just up to the top. Likewise, if just a tiny bit of sugar spills out into the urine, it can be inferred that the blood sugar is just above normal, which is where it should be.

"You want to walk that thin line," explains Faber, "of spilling the absolute minimum excess sugars in the urine to protect against insulin shock and not be so high as to contribute to the deterioration of the body. What the computer does is make it easy for us to perceive what kind of control he's in so we can adjust for changes in insulin needs earlier and more accurately. For example, if he's spilling negative when he should be spilling positive, we just give him a little more food."

The use of the computer is a joint effort between Faber and his wife Debby. During the day, Debby takes about eight urine samples from Ryan and marks down the percentage of sugar in the urine for each hour that a sample was taken. At the end of the week, a full sheet of numbers is brought into the computer room. Steven then loads the program and the computer interrogates for each day and every hour during that day.

"If no tests were taken," he says, "the carriage return is hit without any number being entered. If a test was made, the results of the test are entered as a number at that hour. If the test is negative, zero is entered. If there is a trace of sugar, it's attributed to be a quarter of one percent. One percent is the number one, up to five percent.

"At the end of seven days, the computer prints out individual charts automatically for each day, averages the results for each hour during the week and prints an average chart which gives us a trend projection of what the average day looks like. This is taken to our physician every two months, and a major part of the checkup is going through the book of charts."

The charts tnemselves are arranged with the two insulin curves on top and the urine samples (represented by asterisks), with their respective times when taken, on the bottom. The numbers 0-5 in the vertical column (the letter "T" means a trace of sugar) represent the Clinitest results. High urine sugar levels occur around 1000 and 1800 hours because a meal has just been eaten. But if they were to occur at an unexpected time, it would be cause for alarm. Conversely, too many asterisks in the zero column would mean more sugar should be taken to protect against an insulin reaction. In order to walk that "thin line," therefore, there should be some negative results, some that show a slight spill of sugar (traces, 1's or 2's) and few, if any, 3's, 4's and 5's.

What is the value of charting these statistics, as opposed to simply relying on numerical data?

"Look in the newspaper at the stock market page,"

says Faber, "and tell me whether the market went up or down and by how much. It's almost impossible to tell by looking at the individual stocks. But if you look at a chart of the Dow Jones industrials, you can tell at a glance. It's the same with this program."

The basic value is that in a glance it forms a picture of the diabetic's day in terms of his metabolic processes from hour to hour. So instead of having to look at a page full of numbers, it makes it graphically obvious when there's too much or too little sugar in the urine. The second, and more important value is that by averaging the results each week, trends that don't show up in day to day testing do show up before they become obvious.

For example, it's extremely dangerous for Ryan to get sick. Since running a high fever is like exercising, his sugar is used up and an insulin reaction could occur. If he vomits, his supply of sugar is drastically reduced while the flow of insulin continues, so the same thing could happen.

However, if Ryan has an infection, it will attack the insulin before any symptoms of sickness occur. Therefore, sugar and keytones will appear in his urine. When this happens, the Fabers increase the dosage of insulin and prepare for an impending illness.

PHOTO 1 Ryan at the computer. Notice his medical alert bracelet which identifies him as a diabetic.

It is because of benefits like this that the charts give Debby Faber more confidence in her ability to deal with Ryan's condition.

"It makes me feel that when I go to the doctor, I'm giving him the most information about my child that I could possibly get," she says. "With a child this young, you want the doctor to be as knowledgeable about his condition as possible and to be in touch with every detail. So when I walk into my doctor's office, I'm confident that he can see really quickly what's going on.

"I don't have to say, 'Well, this week he was a little bit high on sugar one day and a little bit low the next and I'm not really sure how the whole week averaged out.' This way I'm sure that he can look at these charts and say, 'I know exactly what to do with your son. I know exactly how much control he has.' It's making my relationship with my doctor really comfortable and I'm much more secure knowing he can track down a problem in a second."

Dr. Rubin says that "Ryan has been doing so well that I've had very little contact with the Fabers other than their normal visits. This is my first experience with the computer in this respect and it's been a learning experience for me. Although juvenile diabetics are notorious for being in and out of control, the computer helps me to evaluate how much in control Ryan has been." Rubin adds that by knowing what's going on with the patient, medical costs can be reduced by avoiding unnecessary tests.

Although Steven Faber is currently the only person using this computer program for diabetes, that could change soon. It may have been created for a juvenile diabetic, but it can also be used for adults, especially those who are new diabetics or are having difficulty keeping in control. In addition, hospitals that have diabetic floors could make use of it.

However, it's difficult to predict when the use of this technique will become, as Dr. Rubin says, "routine."

"Nobody is going to run out and buy a computer to keep track of their diabetes," says Faber, "but we're now moving towards that period of time so long predicted when the computer will become a commonplace appliance in everybody's home.

"Now how far along that road we are I don't know. I do not believe that we are at the point yet when someone who hears about this, knows nothing about computers and has had no predisposition towards buying a computer will go out and buy a system to do this. Those whose natural bent in this direction has put them on a fence and are thinking about getting a computer might find the impetus to go out and do it. But once you have a computer, it's a simple process."

Faber sees the computer as "one of the few generalized tools that have been available in the history of man," and contends that as uses of the computer become more widespread, diabetics who own computers for a variety of reasons will incorporate this application into their systems.

"Fire is a generalized tool," he says. "It was no more designed to be a cooker of meat than a power of rockets. Because of the nature of the computer and the fact that software can be created to produce desired results, in my way of thinking it's a generalized tool.

"In fact, if the computer weren't there (he's had his for three years), I wouldn't have thought of going out and getting a computer to make a diabetes chart. People should consider the computer as a tool in their lives, a generalized tool that they can mold to their specific needs. And this program just shows that when the tool is there, it's instantly of great use."

Faber's program is a simple one. It's written to lead the user along and can be modified to an individual's needs with a minimum of effort or expertise. The hardware necessary is a microcomputer with 4.5 bytes of memory on top of BASIC and a 132 character printer for the charts.

But despite its value, Faber is quick to point out that "the computer at this point does not keep diabetics in control. Diabetics and parents of diabetics keep diabetics in control. The computer is only an aid to make that easier. And since the urine test is an hour behind, the computer is better at predicting trends than handling emergencies, in which a minute can make a big difference."

But even the computer's predictive potential has some enormous implications.

"Because Ryan's so young," says Faber, "and is going to have to live with diabetes for so long, we're trying to avoid that long-term damage to his blood vessels that would show up later in life. That's the value of the program for us."

How much value will it have for other diabetics? Only time will tell. But for now, Faber, who donated this program to INTERFACE AGE, is pleased with what he's done and with the opportunity to make his discovery available to others who need it.

"Obviously I can't do anything about curing diabetes," he says, "so I've just made my contribution this way and I'm doing everything in my power to make it available to the greatest number of people."□

PROGRAM LISTING

```
1 REM PROGRAM TO PLOT CHARTS OF URINE SUGAR WITH INSULIN CURVES
2 REM FOR REFERENCE - - PROGRAM WRITTEN IN MICROPOLIS BASIC VERS. 3.0
3 REM PROGRAM DEDICATED TO CLIFFORD RUBIN, M.D., SIR FREDERICK BANTING,
4 REM J. J. R. MACLEOD, C. H. BEST, AND COWS AND PIGS EVERYWHERE
10DIMD(7,24),I(7,2),W$(7,40)
15DIMD$(2,40)
20DATASUNDAY,MONDAY,TUESDAY,WEDNESDAY,THURSDAY,FRIDAY,SATURDAY
25DIMU(7)
30FORI=1TO7:READW$(I):NEXTI
40FORI=0TO7:FORJ=1TO24:D(I,J)=-1:NEXTJ:NEXTI
50C$="OT!1!2!3!4!5"
100PRINTCHAR$(12):PRINT:INPUT"STARTING DATE FOR RUN";D$(1)
110PRINT:INPUT"CLOSING DATE FOR RUN";D$(2)
120FORI=1TO7:PRINTCHAR$(12):PRINT:PRINT"DATA FOR ";W$(I):PRINT
130INPUT"TIME OF INJECTION";I(I,0):PRINT
140INPUT"DOSAGE (REGULAR,NPH)";I(I,1),I(I,2)
150FORJ=1TO24
160IFJ>19THEN190
170PRINT(J*100)+500;:INPUTD(I,J):GOTO200
190PRINT(J*100)-1900;:INPUTD(I,J)
200NEXTJ:NEXTI
210GOSUB40000:PRINT:PRINT"RYAN FABER: CLINITEST RESULTS FOR WEEK OF: ";
220PRINTD$(1);" TO ";D$(2):FORI=1TO5:PRINT:NEXTI
230FORI=1TO7:PRINT"RESULTS FOR ";W$(I):PRINT
235U=600:U1=-1
260IFU=I(I,0)THEN285
270U=U+15:U1=U1+1:IF(U1+1)/4=INT((U1+1)/4)THENU=U+40
280GOTO260
285U(I)=U1
290PRINTTAB(65)"REFERENCE CURVE":PRINTTAB(65)"***************"
300PRINTTAB(14+U1)"++";TAB(43+U1)"+++";:IFI=0THENPRINT:GOTO310
305PRINTTAB(100)"TIME OF INJECTION:";I(I,0)
310PRINTTAB(13+U1)"+  +";TAB(41+U1)"+     +";:IFI=0THENPRINT:GOTO330
320PRINTTAB(100)"DOSAGE:";I(I,1);"UNITS REGULAR"
330PRINTTAB(12+U1)"+     +";TAB(38+U1)"+";TAB(51+U1)"+";:IFI=0THENPRINT
335IFI=0THEN350
340PRINTTAB(107)I(I,2);"UNITS NPH"
350PRINTTAB(35+U1)"+"
360PRINTTAB(11+U1)"+        +";TAB(32+U1)"+";TAB(55+U1)"+"
370PRINTTAB(10+U1)"+";TAB(29+U1)"+";TAB(57+U1)"+"
380PRINTTAB(9+U1)"+";TAB(20+U1)"+";TAB(26+U1)"+";TAB(60+U1)"+"
390PRINTTAB(8+U1)"+";TAB(21+U1)"+ +";TAB(63+U1)"+"
400PRINTTAB(7+U1)"+";TAB(20+U1)"+ +";TAB(66+U1)"+"
410PRINTTAB(17+U1)"+";TAB(23+U1)"+";TAB(69+U1)"+"
420PRINTTAB(6+U1)"+";TAB(14+U1)"+";TAB(24+U1)"+";TAB(73+U1)"+"
430PRINTTAB(5+U1)"+     +";TAB(26+U1)"+";TAB(79+U1)"+"
440PRINTTAB(4+U1)"+ +";TAB(27+U1)"+";TAB(85+U1);
450FORIO=85+U1TO95:PRINT"+";:NEXTIO:PRINT
455GOSUB460:GOTO550
460FORIO=1TO96:PRINT"=";:NEXTIO:PRINT
480FORIO=1TO24:PRINT"   !";:NEXTIO:PRINT
490PRINT"   600";
500FORIO=800TO2400STEP200:PRINTTAB((((IO-600)/100)*4)+2)IO;:NEXTIO
510FORIO=200TO400STEP200:PRINTTAB(74+((IO/100)*4))IO;:NEXTIO
520PRINTTAB(95)"500"
530RETURN
550PRINT:PRINT
560FORIO=12TO4STEP-1:PRINTMID$(C$,IO,1);
562IFIO/2=INT(IO/2)THENPRINT"-->";
570FORJ=1TO24
575PRINTTAB((J*4)-1);
580IFD(I,J)<=(IO-2)/2ANDD(I,J)>(IO-3)/2THENPRINT"*";:GOTO600
590PRINT" ";
600NEXTJ:IFIO/2=INT(IO/2)THENPRINT"<--";:GOTO620
610PRINT"   ";
620PRINTMID$(C$,IO,1)
630NEXTIO
640FORIO=3TO1STEP-1:PRINTMID$(C$,IO,1);:IFIO/2=INT(IO/2)THENPRINT"-->";
650FORJ=1TO24:PRINTTAB((J*4)-1);
660IFD(I,J)<=(IO-1)/4ANDD(I,J)>(IO-2)/4THENPRINT"*";:GOTO680
670PRINT" ";
680NEXTJ:IFIO/2=INT(IO/2)THENPRINT"<--";:GOTO700
690PRINT"   ";
700PRINTMID$(C$,IO,1)
710NEXTIO
720GOSUB460:PRINT:PRINT:PRINT:PRINT:PRINT
722IFI=1THENPRINT:PRINT
725PRINT:PRINT:PRINT:PRINT:IFI=1THEN730
726PRINT:PRINT:PRINT:PRINT:PRINT
730FORIO=1TO132/3:PRINT"<*>";:NEXTIO:PRINT
735IFI=0THEN800
736PRINT:PRINT:PRINT:PRINT:IFI=1THEN740
737PRINT:PRINT:PRINT:PRINT:PRINT
740PRINT:PRINT:PRINT:PRINT:PRINT:NEXTI
750FORJ=1TO24:K=0:A=0:FORI=1TO7:IFD(I,J)<>-1THENA=A+D(I,J):K=K+1
760NEXTI:IFK=0THEN765
762D(0,J)=A/K
765NEXTJ:I=0
770U1=0:FORQ9=1TO7:U1=U1+U(Q9):NEXTQ9:U1=INT((U1/7)+.5)
780PRINT"AVERAGED RESULTS FOR WEEK OF ";D$(1);" TO ";D$(2)
790PRINT:GOTO290
800GOSUB30000
810END
30000ASSIGN(2,2)
30010RETURN
40000ASSIGN(2,1):RETURN
```

Due to the importance of this article, we recommend that it be copied and used as often as needed. However, proper credit must be given to: INTERFACE AGE, Mat Tekulsky and Steve Faber.

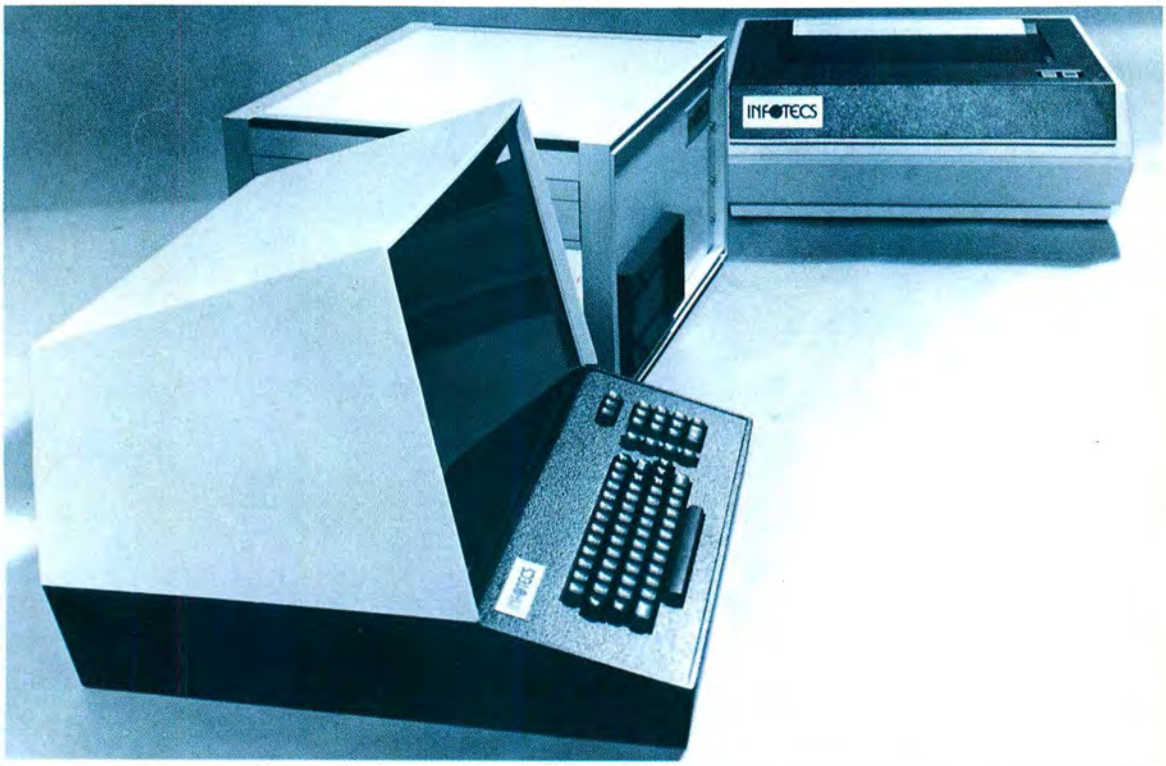
Those of you interested in getting in contact with Steve Faber can write to him at P.O. Box 69200, Los Angeles, CA 90069.

—editor

The Infotecs IMP

An Alternative Machine

By Terry Costlow, Assistant Editor



As computers become more and more accessible for a variety of uses by the small businessman, one of the main problems for those purchasing or considering the new systems is a lack of software. While many companies strive to put out more powerful machines each year, relatively little time and money is put into the development of application software.

Infotecs of Manchester, New Hampshire, countered this problem by designing a system around existing software that had been tested and found to be easily adaptable. The computer system was patterned after the PDP-8™ minicomputer manufactured by Digital Equipment Corporation.

Because the system was architecturally similar to the PDP-8, the software used for that system was easily adapted for use in the Infotecs line.

That line, the IMP (Instant Management Power), utilizes an Intersil 6100 chip. The four-year-old company decided to offer a new system based on that chip technology in February, 1977. The goal of IMP was to present a high-efficiency system at a relatively low cost and to utilize the "end-user" software.

AIMS

To make the system usable by a variety of small businessmen, Infotecs not only planned to make a system that would be relatively inexpensive, but to make it dependable enough to keep customers. To meet their demand, the program was made to be operated without a large amount of training time, had little down time and could grow with the customer's business.

To make the system easy for all businessmen to purchase, Infotecs has aimed at a grassroots network of dealers, with a goal of 200 new dealers nationwide.

New dealers are given a two-day overall course in computer sales, followed by three-day courses in both hardware and software. They are taught to run the machines and to write applicable programs during the software session. During the hardware course, the dealers are taught to trouble shoot circuit boards and peripherals and to assemble a complete IMP system. The obvious purpose of this training is to eliminate some of the down time by allowing the dealers to make some minor repairs.

The system is geared towards the businessman or professional whose sales are more than $200,000 and less than $5 million. Although this range covers a wide variety of businesses, Infotecs feels it has avoided the time problem of attempting to be everything to every business by offering software packages specifically geared to a variety of different types of agencies.

SOFTWARE

By manufacturing the software from the existing product being used with the PDP-8, Infotecs used a software system that had been altered to meet the specific needs of businesses and had already been adapted to the working world.

For example, the package being marketed for general route distribution products such as beer, potato chips and beverages includes programs covering inventory control, driver sales, loading sheets and invoices. The fuel oil dealer's package also covers a variety of needs with a special package available for the related gas station businesses.

Other software currently offered includes time analysis and billing for professionals such as CPA's and lawyers; tire, battery and accessory inventory processing; insurance agency accounting and an accountant's general ledger management system.

General business topics include accounts receivable, payroll functions and accounts payable. All are available for any business.

The system utilizes a language created by Infotecs, HIBOL (Highly Intelligent Business Oriented Language), which is similar to both COBOL and FORTRAN. BASIC was not used in the language because Infotecs programmers did not feel that it was desirable for sophisticated business machines.

Although HIBOL is business-oriented like COBOL, HIBOL works on a higher level. The verb-based language is said to be easier to program than COBOL. Although designed for the IMP, the software can also be used on DEC's PDP-8.

IMP uses the JOEL operating system which allows up to 33 percent more information storage on the disks, an important improvement over most operating systems. This higher density is made possible by splitting the 12-word bits into two characters of six bits each.

HARDWARE

One of the things Infotecs aimed at when the IMP was in the planning stages last year was to create a system that would be a "true plug-in-and-run" system.

This was achieved by making the unit a portable desk top size. Because no special wiring, flooring or air-conditioning is needed for the unit, it can be moved easily if the office is redecorated. The IMP can be plugged into any 110-volt, 20-amp outlet.

The hardware consists of a 24-line CRT terminal with an 80-character per line screen. A total of 1,920 characters can be displayed on the screen at one time. The call-to-display time is a brief one-tenth second.

The terminal, which is in a parallel interface with the printer, is equipped with a standard typewriter keyboard with special function keys and a 10-key adding machine pad for the input of numeric data.

The printer operates at 125 lines per minute, printing 275 characters per second. Nearly any printer on the market today can be interfaced with the IMP terminal. In addition, the printer can be used in conjunction with or independently of the CRT.

Information for the system is held on disks, which hold up to two million characters. The unit can be updated as necessary by adding a second disk drive. That addition would double the amount of on-line information to approximately four million bytes, or characters.

COST OF THE SYSTEM

The IMP system is priced at approximately $10,000 for the hardware, with prices for the package including software varying from $12,000 to $15,000.

The software prices run from $500 for the payroll or gas station packages to $4,500 for the fuel oil dealer's or route distribution setups.

Infotecs markets the IMP and the software through a network of dealers across the country. The dealerships include systems dealers, office machine dealers, service bureaus and computer stores. Infotecs annual sales are currently estimated at $3 million per year. □

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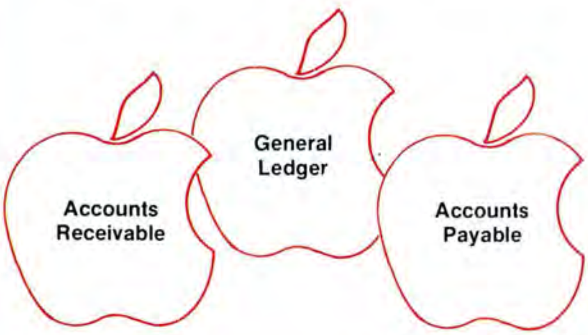

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BUSINESS EDITORIAL

By Keith Parsons
Structured Systems Group, Oakland, CA

WHY IS THERE SO LITTLE GOOD BUSINESS SOFTWARE?

One of the most commonly discussed topics in the microcomputer business these days is the need for good business software. Everyone expects a great deal of quality software to be available soon and at low cost. However, very few business applications are currently available and good new software appears only rarely. When it does appear it is often priced higher than most people expect.

Why is this? There are three major reasons. First, there are no "Large-Scale Integration" (LSI) programmers. Whereas new technology has made it possible to manufacture integrated circuit chips of greater and greater speed and efficiency, no such advance has occurred with programmers. It takes just as long to write a program for a microcomputer as it does to write one for the largest of computers.

Second, with the development of a new CPU, all the basics must be redeveloped. New equipment, a new operating system and new high level languages must be developed before any business applications can be written.

Third, applications must be redesigned for the new equipment, taking into consideration the advantages and limitations of the new equipment. For example, an applications package designed to run on a computer with a 40 megabyte hard disk will certainly have storage problems if it is translated to run on a microcomputer with only 500 kilobyte floppy disks.

A closer examination of the above problems indicates why good software has been so slow to emerge. The first obstacle is the development of reliable equipment. Without such equipment any programming effort is greatly increased.

Once dependable hardware exists, the next problem is getting the operating system. The operating system must be simple enough to fit on a micro and not take dozens of man-years to code and debug. However, it must be powerful enough to provide the functions and disk accessing methods that are needed in a flexible business system.

In addition to the operating system, several support programs are also needed. These include programs such as an editor, an assembler, a sort and debugging routines. Once this software is available, high level languages such as BASIC, FORTRAN, or COBOL can be written. These languages must be exhaustively tested and debugged before they are useful in the production environment of a systems house or accounting office.

The complete process, from the new CPU to the usable system, takes years. It is only in this year that all of the hardware and software described has finally become available for the 8080 microcomputer.

With reliable hardware and system software it is possible to begin serious development of major business applications. This process is also difficult and time consuming. Initially, the programmer must find the right combination of equipment and systems software which allows maximum flexibility and causes a minimum of problems. They must then learn to use the system and the selected language efficiently. This learning process can consume several months.

Now the application design phase can begin. A good design is extremely important. Contrary to popular opinion, it is not possible to copy the design from a minicomputer. The design must account for the different requirements and limitations of the new machine. Microcomputers have less mass storage than the minis, and any micro system must be designed with this in mind.

Most accounting systems designed for minis will require more space than is available on the micros and will have to be redesigned around this problem. The 64K RAM storage limitation may also be a problem. Not only may a 16-bit CPU have more than 64K memory, but it also can do more in that 64K because the mini CPU will have a more powerful instruction set.

Once the system has been designed, with allowances made for the features of the system and future needs, the programming phase can start. This can be a very difficult time on a new system if there are no experts to consult on the system or the language being used.

It is hard to tell whether an obscure error is a user coding error, a newly-discovered bug in the high level language, or a RAM error. Learning all the details of a complex computer system while trying to write major new business systems can make progress painfully slow.

When the system is finally written, it must be exhaustively tested. The testing phase often takes longer than the coding phase. A system with 25,000 lines of code is going to take a lot of testing to exercise and exorcise all parts of the system. If the software is released for distribution before it is completely tested, the results may be disastrous.

The final step, documentation, is often the weakest. With mass distribution of new software, excellent documentation is a necessity. A user in Florida is not going to want to ask the programmer in California how to use the system or what a certain error message means. Documentation is a particularly difficult problem because most professional programmers are not professional writers and do not care to be.

Now that we see the problems in developing good business systems, the next question is who is doing it? It can take several man-years to produce a major business system and the initial capital investment can easily run to hundreds of thousands of dollars.

To date, most of the equipment manufacturers have invested their time and money in improving their product line. They haven't had the time or money to invest in developing major business systems. Few individuals have the necessary combination of experience, capital, and time required to develop a salable software system. This leaves software houses as the major candidates for producing quality business systems. However, no software house can afford to invest hundreds of thousands of dollars to develop a major supported system and sell it for $50.

Equipment and systems software are now available to support business systems. The desire for professional business applications is growing, along with a recognition of the accompanying problems. Combining this desire with that of forward looking manufacturers who recognize the value of good applications should create an environment in which serious software development is profitable.

But this will create a new problem. With new business software being sold in computer stores run by individuals with hardware expertise and little business experience, how does one evaluate what is being offered?□

Some Basics of Accounting

By James W. Kitzmiller
President, Kitzmiller Systems

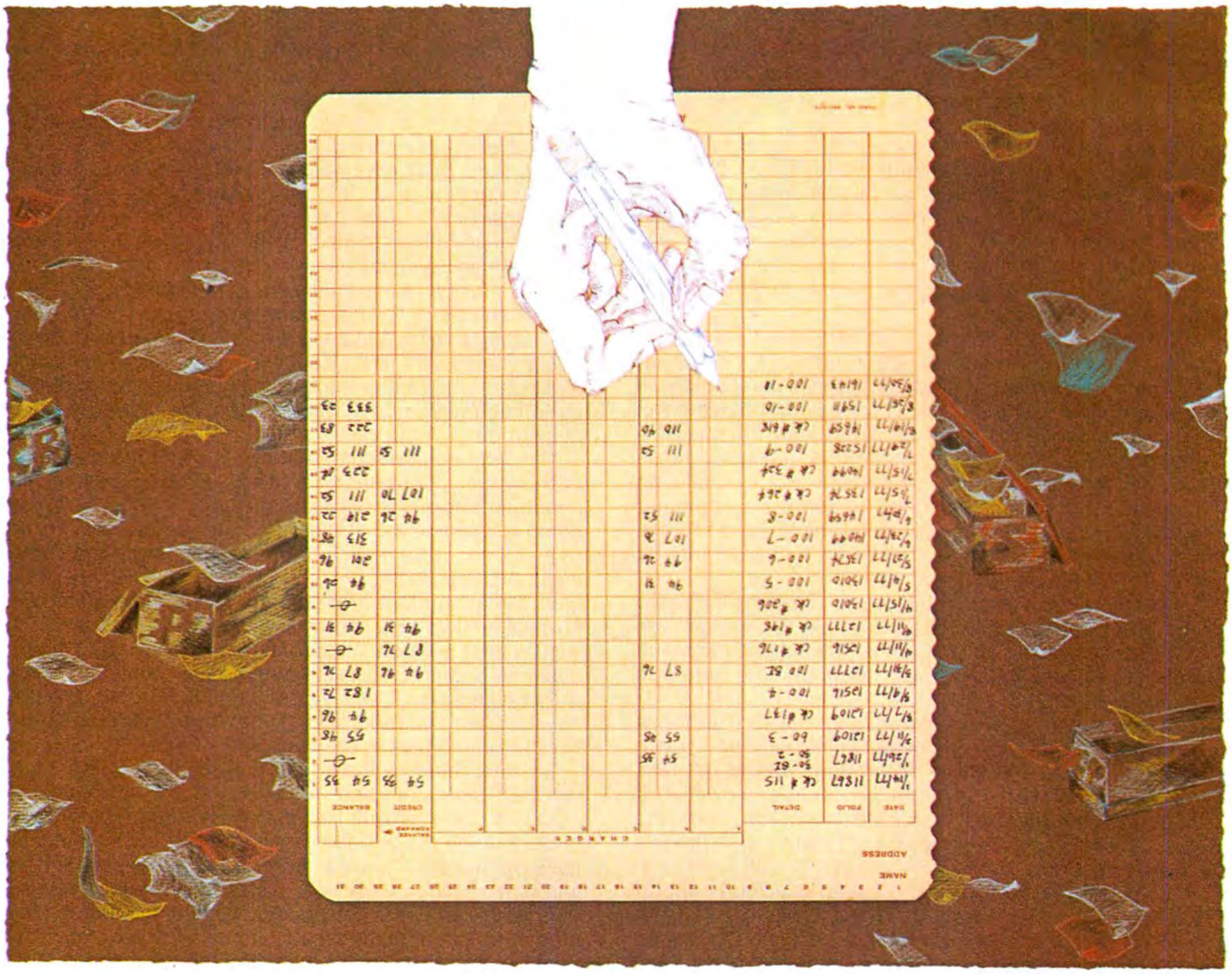

Illustration by Samantha Lee

Over the past few months we have been demonstrating our software on the AM-100 computer system. We have received a variety of reactions from the people that saw our system and have come to the conclusion that many people are unfamiliar with the language associated with computer systems. In order to alleviate some of the difficulties, which probably also take place in computer stores across the country, we'll define a few of the basic concepts in accounting as they would apply to computers.

First of all, take a look at the definition of accounting. Accounting is that activity which concerns itself with recording, sorting and summarizing data relating to business activities. For example, you may buy a stack of paper from the supply company. The act of doing that would be a transaction. Accounting is the activity of recording transactions such as this. The purpose of accounting is to gather all this data together in a seemingly random fashion, chew all this data up, spin it around and spit it out in the form of a useful report.

Consider some of these reports. The most common report that people see is the Profit and Loss Statement, sometimes called an Income Statement. This profit and loss statement shows how much money you made in a given time period, say over the last month. The Profit and Loss Statement is a fairly simple thing. It lists all of the areas where you took money in, such as sales out of your Chicago office or sales out of your Houston office, and it combines all of those. That adds together into something called Total Income.

Then another section of the Profit and Loss Statement would contain your expenses. The expenses could be items such as salaries to employees, materials expense, rent, telephone and so forth. You simply substract the total expenses from the total income and you get your profit for the month.

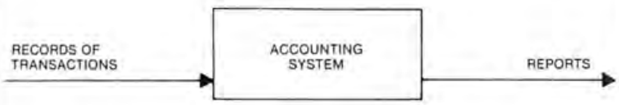

Figure 1. Basic Accounting Flow

Another type of report that is quite common is a Balance Sheet. A Balance Sheet shows you how much your business is worth and where the various worth is spread around. The Balance Sheet is divided into three major areas: assets, liabilities and capital. Assets are things such as cash, equipment owned, the building you are making mortgage payments on and so forth. Liabilities are things such as debts and mortgages. Capital is how much you would have if you cashed out your business. If you sold all of the assets of your business and paid off all your bills, capital would be how much you have left.

A Balance Sheet lists all of the assets, or at least it lists categories of assets and how much each of those categories are worth. These add up to "total assets".

The next section of the Balance Sheet shows liabilities. The liabilities could be distributed into various categories such as accounts payable, notes payable and mortgages.

Finally, capital could be one line or a number of lines. Capital could be distributed over several partners in a new business, and the report may show that the various owners have different amounts of capital.

Take a look at the Balance Sheet in Figure 2, and you will notice that the total assets is equal to the sum of the liabilities and the capital.

KUNG FU IMPORTS
BALANCE SHEET
1 AUGUST 1978

ASSETS			
CASH	13.3%		
ACCOUNTS RECEIVABLE	5.7%	$ 2,461.00	
SUPPLIES	7.9%	$ 1,050.00	
PREPAID RENT	8.1%	$ 1,450.00	
PHOTOGRAPHIC EQUIPMENT	65.0%	$12,000.00	
ACCUMULATED DEPRECIATION	0.0%	$ 0.00	
TOTAL ASSETS	100.0%		$18,461.00
LIABILITIES			
ACCOUNTS PAYABLE	10.8%	$ 2,000.00	
SALARIES PAYABLE	0.0%	$ 0.00	
TOTAL LIABILITIES	10.8%		$ 2,000.00
CAPITAL			
JOHN REED, CAPITAL	89.2%		$16,461.00
TOTAL LIABILITIES & CAPITAL	100.0%		$18,461.00

Figure 2. Balance Sheet

GETTING THE DATA INTO THE SYSTEM

Now take a look at how all of this data gets into the computer system. This can best be understood by taking a look at what you do every April 14th. During the year when you make any kind of transaction or purchase for your business, you take the corresponding scrap of paper and throw that into a shoe box. In accounting, this shoe box would be called a journal. A journal is a place where you record transactions as they occur. You can also enter information every time you make a sale. You write the information on a scrap of paper and throw it into the same shoe box where you keep records of expenses. A shoe box such as this could be called a general journal.

There could also be specialized types of journals. If you have a separate journal for sales, you have a sales journal or a cash receipts journal. If you buy something from a supplier on credit, you would record it in a purchases journal. Cash purchases would be recorded in a cash payments journal. For each group of special transactions there would be a specialized journal.

Every year on April 14th you're going to have to do something with all of those shoe boxes which you consider your journals. You separate them into different piles on your living room floor. Now, each of those piles is called an account. You could have a pile where you put all of your receipts for your phone bills, and that pile would be called the telephone expense account, and so forth.

The action of sorting these scraps of papers into different piles is called posting. If you are doing this on your living room floor, your living room floor could be called a ledger. A ledger is a book that has transactions divided into these various categories or various accounts.

After you are finished posting, you are going to arrange this information into a report. The report you're most likely to make at this time would be the Profit and Loss Statement. What you do is combine your information (or piles) into areas of similarity. If you put all of

your expense piles into one area, and you put all of your income piles into another area, you are simply constructing a report.

When you tell a computer how you want your reports to look, you are sorting this information into certain areas. Again, Figure 3 shows what a profit and loss statement looks like. This is effectively what you have been striving for.

KUNG FU IMORTS
INCOME STATEMENT
JULY 1978

SALES	100.0%		$ 3,725.00
OPERATING EXPENSES			
SUPPLIES EXPENSE	0.0%	$ 0.00	
SALARY EXPENSE	13.7%	$ 510.00	
RENT EXPENSE	0.0%	$ 0.00	
DEPRECIATION EXPENSE	0.0%	$ 0.00	
MISCELLANEOUS EXPENSE	5.5%	$ 204.00	
TOTAL OPERATING EXPENSE	19.2%		$ 714.00
NET INCOME	80.8%		$ 2,011.00

Figure 3. Profit and Loss Statement

If in the next year you want to zero out all of those expense accounts and income accounts, because you have effectively realized a change in the net worth of your business over that time, you simply change the amount of the capital on the balance sheet described earlier. Remember that the capital is the net worth that you have in your business.

These various expense accounts and income accounts in the long run just affected how much the net worth of your business was, so at the end of the year or at the end of the month, if you so choose, you can go through an action called year-end closing or month-end closing. That's where you take all of those scraps of paper and put them away where you can't see them anymore. You add the amount of profit for that time period onto the capital or net worth that you have in your business and you are ready to start over again for a new time period. If you have a simplified procedure on your computer system such as we have tried to do with our Business Management System for the AM-100, this process will be less of a strain.

MORE DATA ON HOW TO GET DATA INTO THE COMPUTER

Now that we have taken a look at what kind of reports we want and the general ideas on how you get there, we will take a more detailed look at some of the basics of accounting. One basic of accounting is called the accounting equation. The accounting equation says simply that your net worth is equal to how much you have minus how much you owe; in other words, capital equals assets minus liabilities. This is usually stated in another way: assets equals liabilities plus capital.

Take a look at the balance sheet in Figure 2 and you will see the assets enumerated as well as the liabilities and the capital. Notice that the assets equal the liabilities plus the capital. Remember that you only have a good record of this if you have done month-end closing or year-end closing because all the accounts haven't been used to change the amount of capital that the owner of the business has. For example, let's say that you just got a $400 phone bill and you paid it. Your capital has gone down by $400, but that fact is not noted until you have done your month-end closing. That's the basic accounting equation.

Look at what a double entry system is. If you are away from your office with checks but without your checkbook and you write a check, you write two scraps of paper; one is to note in your checkbook that you spent $10; and one to note the fact that you got an additional $10 worth of office supplies, such as paper. You throw these two scraps of paper into your shoe box.

Now when you are doing the double entry system, you could have a special shoe box with two halves in it, a left half and a right half. You throw one scrap of paper into the left half and the other into the right half. The left half of the shoe box would be called debits and the right half would be called credits.

The debits are considered plus for some types of things and minus for other types of things and the same thing for credits. Take a look at what's plus and what's minus for these various things. A debit is a plus for assets such as cash, and it is minus for liabilities and capital. On the other side, a credit is minus for assets such as cash, and it is plus for liabilities and plus for capital.

You can keep things straight if you remember that cash is positive on the left side, which is debits. For example, if you want to spend $10 cash to buy paper, but you don't have enough cash, your cash is going to be minus and that minus goes on the right. Then your supplies expense goes on the left. Supplies expense is debits, and you would credit cash. Whenever you put something into the right, you must put an equal dollar amount on the left. You take those two scraps of paper used to make the $10 purchase, note the fact that you have spent the $10 cash and throw that into the right half of the box. Note the fact that there was a $10 expense for office supplies and put that into the left half of the box.

When you are doing this by hand, you have to keep track of a bit more than you do with the general ledger section of our Business Management System. We try to keep it as simple as possible. The basic thing to remember here is that whenever you enter something into this big shoe box called the general journal, two things change at the same time. For example, when you change cash, you change something else such as supplies expense.

One nice thing about some of these special shoe boxes is that you know you are always spending cash. You don't have to write a separate scrap of paper for cash every time you spend some. The fact that you have thrown one scrap of paper into that cash payments shoe box is enough to record the fact that it was cash that went out, and you don't have to do that a second time. Our general ledger system has this feature. It's got the cash payments journal; it also has a cash receipts journal.

SOME MORE REPORTS

When all of these journals are compiled, we get the computer to print out what took place in each of these various journals. One report would be just a listing of all the transactions that took place in the general journal. We call this the General Journal Printout, and this is part

of the General Ledger Section of our Business Management System. Figure 4 shows that particular report.

KUNG FU IMPORTS
GENERAL JOURNAL

DATE	ITEM	POST		
MAR 1	ACCOUNTS RECEIVABLE	12	$ 650.00	
	JOHN REED, CAPITAL	31		$ 650.00
MAR 1	SUPPLIES	14	$ 800.00	
	JOHN REED, CAPITAL	31		$ 800.00
MAR 1	PHOTOGRAPHIC EQUIPMENT	18	$ 9,500.00	
	JOHN REED, CAPITAL	31		$ 9,500.00
MAR 4	PHOTOGRAPHIC EQUIPMENT	18	$ 2,500.00	
	ACCOUNTS PAYABLE	21		$ 2,500.00
MAR 31	ACCOUNTS RECEIVABLE	12	$ 975.00	
	SALES	41		$ 975.00

Figure 4. General Journal Printout

Another report is a printout of the Cash Receipts Journal. Figure 5 shows that. It's simply a list of all of these scraps of paper that were thrown into that particular shoe box.

KUNG FU IMPORTS
CASH RECEIPTS JOURNAL

DATE	REF	CREDIT ACCOUNT	POST	AMOUNT
1 MAR 1978		JOHN REED, CAPITAL	31	$ 2,500.00
5 MAR 1978		ACCOUNTS RECEIVABLE	12	$ 575.00
16 MAR 1978	1004	SALES	41	$ 1,280.00
31 MAR 1978	1005	SALES	41	$ 1,470.00

Figure 5. Cash Receipts Journal

The report shown in Figure 6 is a Cash Disbursements Journal. That is simply a report of all of the scraps that were thrown into that particular shoe box.

KUNG FU IMPORTS
CASH PAYMENTS JOURNAL

DATE	CHECK	DEBIT ACCOUNT	POST	AMOUNT
1 MAR 1978	1023	PREPAID RENT	15	$ 1,500.00
6 MAR 1978	1024	MISC EXPENSE	59	$ 80.00
10 MAR 1978	1024	ACCOUNTS PAYABLE	21	$ 500.00
13 MAR 1978	1025	SALARY EXPENSE	52	$ 235.00
20 MAR 1978	1026	SUPPLIES	14	$ 650.00
27 MAR 1978	1027	SALARY EXPENSE	52	$ 275.00
31 MAR 1978	1028	MISC EXPENSE	59	$ 39.00
31 MAR 1978	1029	MISC EXPENSE	59	$ 85.00

Figure 6. Cash Payments Journal

There's another report called a Trial Balance. This trial balance is done after the posting procedure. Remember that posting is the action of dividing all of these scraps of paper into their appropriate piles. You add up the amounts of the scraps of paper in each pile, and then you put some of these piles on your left side and some on your right side. The piles on your left side would be the debits, and remember that debits are things such as assets and expenses. The piles on your right side are credits. Credits are things like liabilities, capital and income. You take all of these things, list them all out one by one, and you get the dollar amount. When you do this, you perform a thing called the trial balance.

KUNG FU IMPORTS
TRIAL BALANCE
1 AUGUST 1978

CASH	$ 2,461.00	
ACCOUNTS RECEIVABLE	$ 1,050.00	
SUPPLIES	$ 1,450.00	
PREPAID RENT	$ 1,500.00	
PHOTOGRAPHIC EQUIPMENT	$12,000.00	
ACCUMULATED DEPRECIATION	$ 0.00	
ACCOUNTS PAYABLE		$ 2,000.00
SALARIES PAYABLE	$ 0.00	
JOHN REED, CAPITAL		$13,450.00
JOHN REED, DRAWING	$ 0.00	
INCOME SUMMARY	$ 0.00	
SALES		$ 3,725.00
SUPPLIES EXPENSE	$ 0.00	
SALARY EXPENSE	$ 510.00	
RENT EXPENSE	$ 0.00	
DEPRECIATION EXPENSE	$ 0.00	
MISCELLANEOUS EXPENSE	$ 204.00	
TOTAL	$19,175.00	$19,175.00

Figure 7. Trial Balance

The basic idea of a trial balance is to make sure that the total of everything in the left pile equals the total of everything in the right pile. Or in other words, all of the debits equal all of the credits when they are added up. Figure 7 shows a Trial Balance. Our general ledger system doesn't allow you to make mistakes. This trial balance will come out correctly. It always makes sure everything is in balance before it goes into the computer.

CONCLUSION

We've gone through some of the basic accounting concepts that you need to understand your computer system. More detailed information will be available in the user's manual for your particular computer system. Recall that what you are doing with your computer is feeding in data corresponding to those little scraps of paper. Every time you enter data into the computer, you're effectively throwing one of those scraps of paper into a shoe box, and the computer takes it from there. It categorizes data into various areas and prepares reports for you. With these reports you should have information that will help you make sound business decisions so that you can reduce expenses and increase profits. □

ABOUT THE AUTHOR

James W. Kitzmiller is president of Kitzmiller Systems, the major source of business software for the AM-100 computer. Jim holds a Masters of Science in Electrical Engineering. He has completed his Ph.D. course work in Management Science. Kitzmiller Systems, a Los Angeles based company, also sells computer hardware, does systems analysis, contract programming and markets the AM-100 software internationally.

1979 COMING ATTRACTIONS

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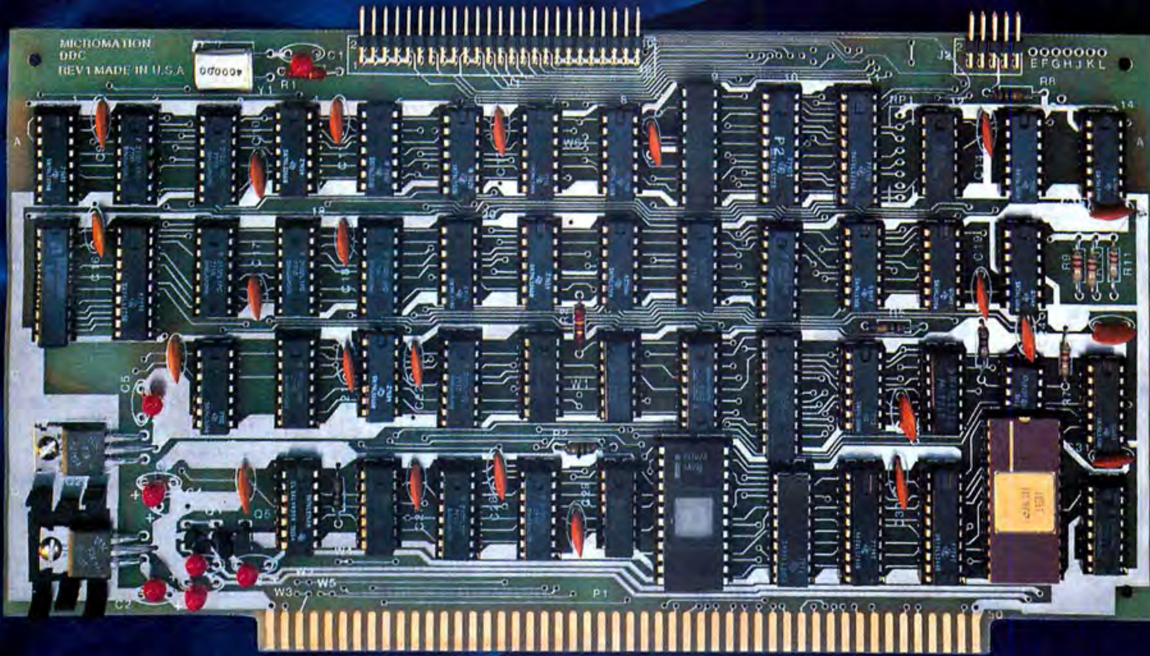

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Sequential Files

By Martin Knight

One of the many uses for computers today is the keeping of files of one sort or another. Frequently, these files are sorted according to one or more factors. One problem arising from sorted files is that of adding a new file to the already existing one so that the proper sequence is maintained.

With this problem in mind, this author wrote the subroutine appropriately named WEDGE. The subroutine is very simple, but the techniques involved can be extended to more complicated situations such as filing signed numbers in numerical order or alphabetizing a list.

Basically, the subroutine begins with an array of numbers which are already sorted from smallest to largest. The beginning address of the array minus one should be stored in the locations named ARRAY. Since the address of the end of the array may be unknown, the subroutine uses the number of array elements instead. This number should be stored in location NUMB and should be less than 256. It would be a simple procedure to alter the program to accommodate array sizes in excess of 256 if necessary.

The new item to be entered is stored in location ENTRY. This is assumed to be an unsigned HEX number less than FF. The subroutine scans down the array until a number larger than or equal to the number in ENTRY is found. The variable J is then used to move all entries below that point down one space in memory to accommodate the new element. The new number is inserted and NUMB is increased by one to update the size of the array. The subroutine may be called again by simply placing the new item in location ENTRY and calling the subroutine.

The direct mode of addressing has been used primarily to keep the length of the program to a minimum. This mode also seems to lend itself quite well when a program which alters itself is attempted.

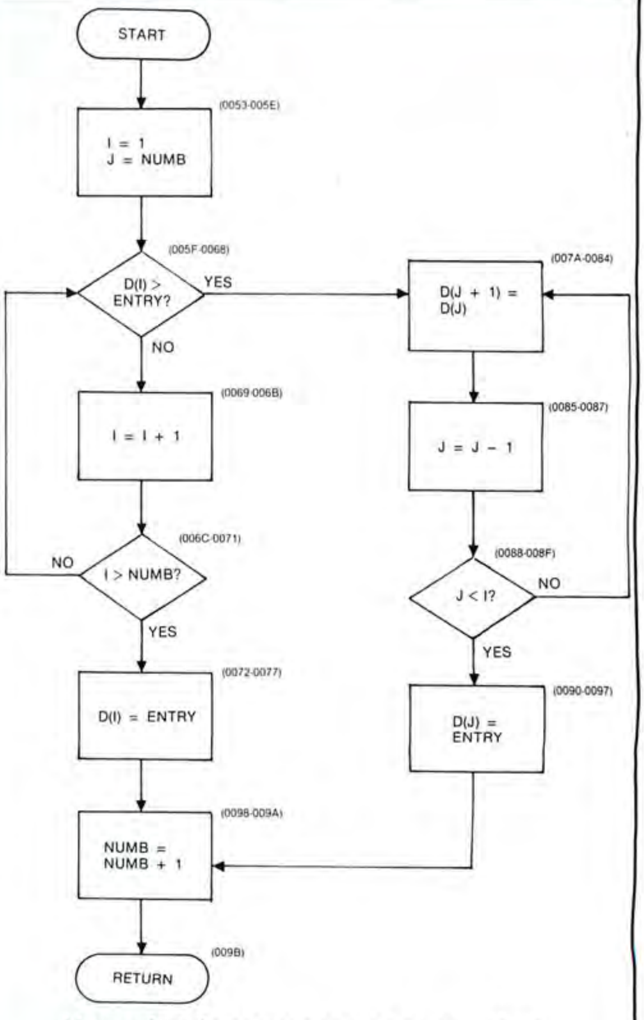
The program can be rewritten for relocation anywhere in memory, but with some sacrifice in terms of length. □

Table 1. Subroutine WEDGE General Information

1. The following locations are needed in addition to memory for program statements:

M(0006) = I	(Pointer to beginning of array)
M(0007) = J	(Pointer to "end" of array)
M(0008) = NUMB	(Number of array elements, max of FE)
M(0009) = ENTRY	(New entry, an unsigned HEX number)
M(000A) = ARRAY	(High order byte of array address)
M(000B) = ARRAY	(Low order byte of array address MINUS ONE)

2. The subroutine works with unsigned HEX numbers only and is designed to operate in conjunction with subroutine SORT.
3. The program must be entered with the number of array locations before the new entry is made in NUMB, the new entry in ENTRY, and the address of the start of the array minus one in ARRAY.
4. The array used before the new entry is included must be in order from largest to smallest.
5. The program inserts the new value into the array in its proper location while moving all values larger than the new entry (marked by J) up one location in memory.
6. The program alters the value of NUMB to reflect the new addition to the array.
7. Direct mode of addressing has been used, so relocation is easiest within the bottom 256 bytes of storage.
8. The program alters itself to point to the correct array locations. The locations 0064, 0077, 0084, 0097 while starting with a value of 00 are designed to change as the program progresses. These values are completely arbitrary until the program is in motion. The program will work correctly with any value in these locations as long as it is started from the beginning.



Lines of code corresponding to flowchart blocks appear in parentheses.

— WEDGE

PROGRAM LISTING

```
*THIS SUBROUTINE WILL PLACE A NEW ENTRY INTO ITS PROPER POSITION IN
*AN ARRAY WHICH HAS BEEN ORDERED FROM SMALLEST TO LARGEST (UNSIGNED
*HEX NUMBERS) AND MOVE THE NECESSARY ELEMENTS IN THE ARRAY DOWN
*ONE POSITION IN ORDER TO ACCOMODATE THE NEW ENTRY. ENTER THE
*SUBROUTINE WITH THE NUMBER OF ELEMENTS IN THE ARRAY BEFORE THE
*ADDITION OF THE NEW ITEM IN LOCATION ØØØ8, THE NEW ENTRY IN
*LOCATION ØØØ9, AND THE ADDRESS OF THE BEGINNING OF THE ARRAY
*MINUS ONE IN LOCATIONS ØØØA-ØØØB. THE SUBROUTINE RETURNS THE
*ARRAY CONTAINING THE NEW ENTRY IN ITS PROPER LOCATION AND THE
*NEW NUMBER OF ARRAY ELEMENTS IN LOCATION ØØØ8. RELOCATABLE WITHIN
*THE FIRST 256 BYTES EXCEPT FOR THE FOLLOWING:
*     M(ØØØ6)=I             (A POINTER)
*     M(ØØØ7)=J             (A POINTER)
*     M(ØØØ8)=NUMB          (NUMBER OF ARRAY ELEMENTS)
*     M(ØØØ9)=ENTRY         (NEW ENTRY INTO ARRAY)
*     M(ØØØA)-M(ØØØB)=ARRAY           (ARRAY START ADDRESS MINUS ONE)

LOC          LABEL      MNEMONIC            CODE        COMMENT

ØØ53         WEDGE:     CLR I               7F ØØ Ø6    ;Initialize I,J,X
ØØ56                    INC I               7C ØØ Ø6    ;
ØØ59                    LDAA NUMB           96 Ø8       ;
ØØ5B                    STAA J              97 Ø7       ;
ØØ5D                    LDX ARRAY           DE ØA       ;
ØØ5F         TESTGT:    LDAA I              96 Ø6       ;Point to first elt.
ØØ61                    STAA INDEXI         97 64       ;Store in prgm.
ØØ63                    LDAB INDEXI,X       E6 ØØ       ;Get D(I)
ØØ65                    CMPB ENTRY          D1 Ø9       ;D(I)> ENTRY?
ØØ67                    BHI MOVUP           22 11       ;Yes, go to MOVUP
ØØ69                    INC I               7C ØØ Ø6    ;No, bump I pointer
ØØ6C                    LDAA I              96 Ø6       ;
ØØ6E                    CMPA NUMB           91 Ø8       ;Is I> NUMB?
ØØ7Ø                    BLS TESTGT          23 ED       ;No, test next one
ØØ72                    STAA INDEXI1        97 77       ;Yes, put at end
ØØ74                    LDAB ENTRY          D6 Ø9       ;
ØØ76                    STAB INDEXI1,X      E7 ØØ       ;
ØØ78                    BRA INCNUMB         2Ø 1E       ;Go to INCNUMB
ØØ7A         MOVUP:     LDAA J              96 Ø7       ;Make room for
ØØ7C                    STAA INDEXJ         97 7F       ;new element by
ØØ7E                    LDAB INDEXJ,X       E6 ØØ       ;moving all entries
ØØ8Ø                    INC A               4C          ;larger than it
ØØ81                    STAA INDEXJ1        97 84       ;down one
ØØ83                    STAB INDEXJ1,X      E7 ØØ       ;
ØØ85                    DEC J               7A ØØ Ø7    ;Do this until
ØØ88                    LDAA J              96 Ø7       ;J is smaller
ØØ8A                    CMPA I              91 Ø6       ;than I
ØØ8C                    BHI MOVUP           22 EC       ;
ØØ8E                    BEQ MOVUP           27 EA       ;
ØØ9Ø                    LDAA I              96 Ø6       ;Put the new
ØØ92                    STAA INDEXI2        97 97       ;element in its
ØØ94                    LDAA ENTRY          96 Ø9       ;correct place
ØØ96                    STAA INDEXI2,X      A7 ØØ       ;
ØØ98         INCNUMB:   INC NUMB            7C ØØ Ø8    ;Bump NUMB
ØØ9B                    RTS                 39          ;Return
```

SUBROUTINE

```
S113ØØ537FØØØ67CØØØ696Ø897Ø7DEØA96Ø69764D7
S113ØØ63E6ØØD1Ø922117CØØØ696Ø691Ø823ED9738
S113ØØ7377D6Ø9E7ØØ2Ø1E96Ø7977FE6ØØ4C9784FE
S113ØØ83E7ØØ7AØØØ796Ø791Ø622EC27EA96Ø6977B
S1ØCØØ9397960Ø9A7ØØ7CØØØ839C6S9
```

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The Techniques of Data Entry

By William L. Colsher

One of the most important parts of any large computer installation is the data entry department. To a large extent, the quality of the work done by any computer is dependent upon the quality of the data supplied to its programs. You've probably heard the word GIGO — Garbage In, Garbage Out. This rather silly phrase is so true that many companies, large and small, spend thousands, even millions of dollars to insure that the data which reaches their files through many different programs is as accurate as possible.

Since you're reading this magazine, it's probable that your entire system costs less than a keypunch machine from IBM. I recently saw an advertisement for used keypunches at $1,900.00. For this reason, you might protest that you don't really need to set up a special system just to type in data. "I can't afford to have a system like that" is a common phrase when discussing input editing with someone who doesn't use it. Another argument is "I'll be entering the data myself, not some keypuncher. I know what everything means, and I'll see any mistakes I might make." Sure you will.

Let's say that you own a drugstore. What would happen if the computer you use sent out a bill to the wrong customer? Sure, you only transposed two digits in the ID number. Anybody can make a mistake like that. Unfortunately, computer errors are only funny when they happen to someone else.

Verifying a check digit is a snap for a computer, and they are used every day in virtually every major business computer system. You've probably heard examples of this type of error: John Doe gets a bill for 9,000 dollars, the real bill was ninety dollars. A test called a range-check would have prevented the error in most cases. One problem with this technique is that it is often difficult or impossible to establish a valid range of values.

One of the major problems in large data processing installations is dealing with just plain bad data. By bad data I mean times when the wrong characters are punched in a card or onto whatever other media is being used. The classic example of this is the placing of alphabetic characters where numeric characters are supposed to go. This is caused by a piece of incredibly bad design in keypunches. The numeric keys overlap the alphabetic keys. They are arranged to look like an adding machine keyboard, a good idea. To punch a number, you must either provide a special control card which tells the machine to shift into numeric mode or physically hold down a "NUMERIC" key that gives the same result. Those cards are not always made correctly, and it is very easy to miss the key. Both result in letters where numbers should be. The best program in the world will die a horrible death if it is fed data like that. Amazingly, this is one of the most overlooked points in data processing; few programs check to see that numeric data is actually numeric.

CHECK DIGITS

Let's say that you've decided that a seven digit account number is sufficient for your purposes. Now we'll add one more digit onto the end, the check digit. To add that digit on, we must have some sort of program that will generate it, given the seven digit account number. The routine must also give a different check digit if any digits are transposed in the entry of the number. This requirement rules out simply adding up the digits in the account number.

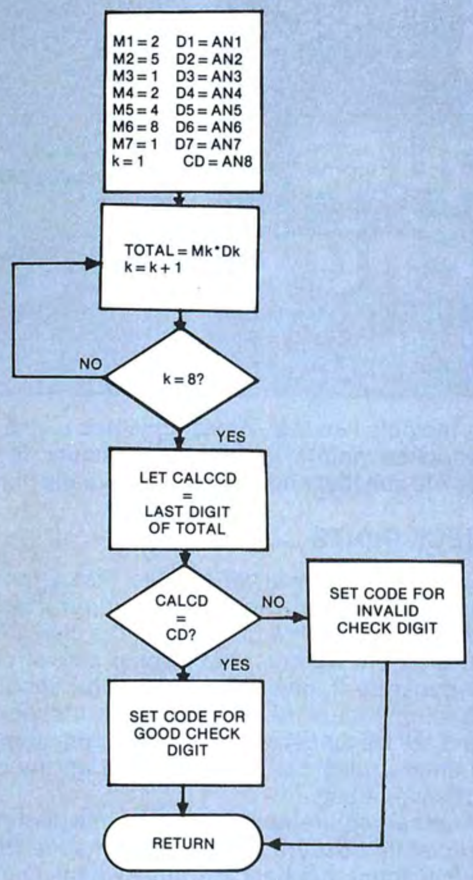
Another requirement is that the check digit routine be sufficiently obscure to prevent someone from entering false account numbers into the system. One way that is commonly used is to multiply each digit of the number by some other number. We want the routine to be as fast as we can make it since each entry into the system will go through this routine. For this reason, we'll use only single digits to multiply by, and we'll save only the last digit of the result. The last digits of the result we'll add up, and the last digit of that will be our check digit.

If this sounds rather confusing, take a look at Flowchart 1, and it should become clearer. You are probably wondering where I got those numbers which I multiply by in the flowchart. Those numbers are the first digits of the second seven powers of two (2^8, 2^9, etc.). To make it a little clearer, $2^8 = 256$, so the first number is 2, $2^9 = 512$, so the second number is 5 and so on. Example 1 shows a worked out run through and what happens when two digits are transposed.

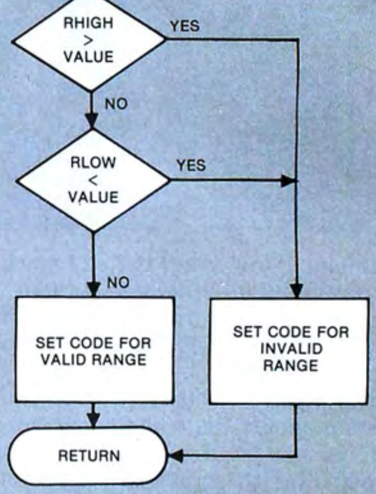
RANGE CHECKING

Range checking is perhaps the simplest in concept of the three techniques we're discussing, but in practice it is often difficult to implement. The problem lies in determining exactly what is a valid range of values for a given input field. In some cases the process is simple. For example, you might want to give no one more than 500 dollars in credit. In this case, you would want to verify on input that no transaction was for more than $500.00. Another easy example would be in an inventory system. You know that you have no inventory numbers larger than, say, 99999, so the check is easy to make.

Here's an example that looks good at first but will eventually get you into trouble. Let's say that you know you have no single item in your store costing more than 250 dollars. You decide to put in a check to make sure



Flowchart 1



Flowchart 2

Example 1

Given: The account number is 35143384

NOTE: The check digit is 4

Transpose 2 digits (the most common error) giving: 53143884

Calculate the check digit:

```
2*5 = 10
5*3 = 15
1*1 =  1
2*4 =  8
4*3 = 12
8*3 = 24
1*8 =  8
---------
      68
```

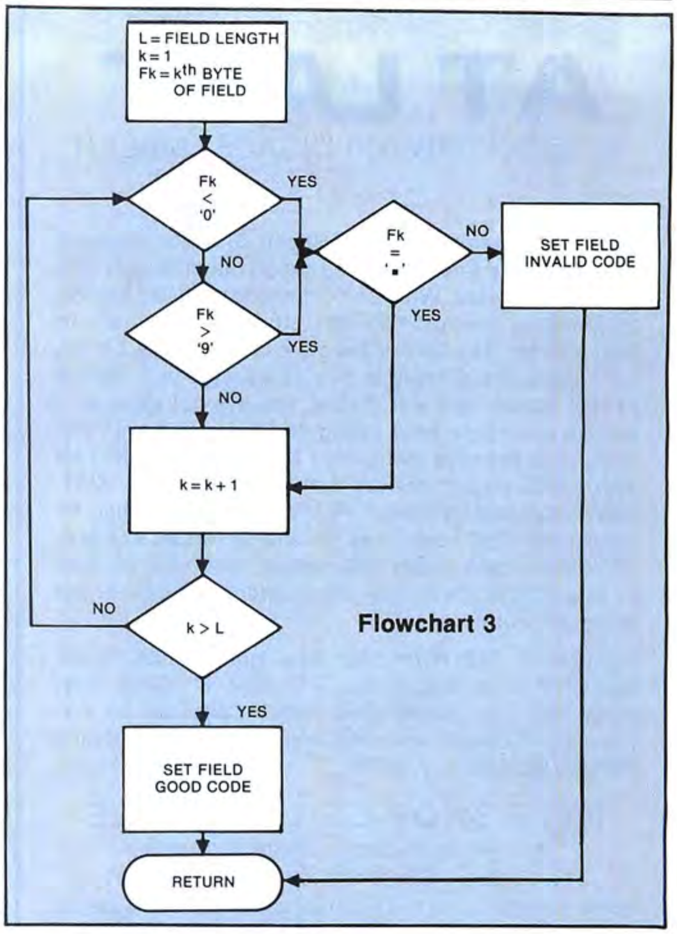
The new check digit is 8. 8 ≠ 4 so the account number is invalid.

that nobody ever gets overcharged as a result of a data entry error. In the routine you use that $250.00 value. Sooner or later, next month or next year, you're going to have an item that costs more than $250.00.

The routine you have coded also does nothing to verify that a customer has been undercharged. Billing people $2.50 for a $250.00 item makes your customers happy but doesn't really help you. Flowchart 2 shows a range check routine that is quite simple. One drawback of this particular routine is that it will only check one range of numbers.

The third verifying numeric data technique is verifying that numeric data is really numeric. Most large installations have restart procedures for their programs so that if a program blows up half way through a run, it is not necessary to re-run it from the beginning. In the case of microprocessor based computers, developing such restart systems is ridiculously expensive when compared to the entire cost of the system and, taking into account how such systems are operated, would be incredibly difficult. Thus, the best thing to do is to make sure that the data you feed your program won't cause it to blow up.

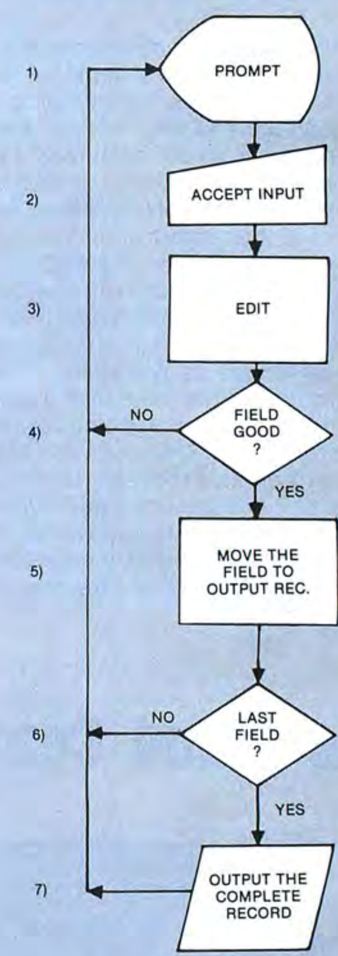
We know that the numbers 0 through 9 form a continuous sequence of codes in ASCII. For this reason, a numeric check is really little more than a range check on the surface. There is one small complication, however. To type in dollar amounts, it's necessary to have a decimal point. Therefore, it's necessary to include a check for that decimal point to prevent a valid number from being rejected. We should also include some means of *not* checking for the decimal point in numbers which should not have one. An examination of Flowchart 3 will reveal how this can be done.



Flowchart 3

COMBINING THE TECHNIQUES

The next step is combining these techniques into a program which will accept as input raw data from a keyboard, perform the appropriate validations, and finally output the clean data to some mass storage device for input into the inventory program or whatever.



Flowchart 4

Flowchart 4 will give you some idea of what this sort of program does and how it does it. This type of program assumes that it has access to something we'll call a Field Descriptor Table. This table contains information on each field in a given record. An example of the kind of information found in such a table is given in Table 1.

The first item in the table is the Field Number. If this number is a hexadecimal FF (in this example), the edit driver will know that the preceding field was the last one in the record (see step 7 in Flowchart 4). The next item in the table is the Field Name. This will be used by the program to prompt the person entering data for the required information (step 1 in the flowchart). An example of the sort of thing Field Name might contain could be "COST" or "STOCK NUMBER".

The third item in the table is Field Length. This information will be used several times by the program. First, when the data is actually entered, it is needed by the computer to tell it how many characters to read in (step 2 in the flowchart). The second use of the information

Table 1.

NAME	LENGTH	DESCRIPTION
1. Field Number*	1 byte	The number assigned to the field
2. Field Name	15 bytes	A meaningful name for the field
3. Field Length	1 byte	The number of characters in the field
4. Output Location	2 bytes	The location the field will have in the record
5. Edit Criteria**	1 byte	What type of editing is to be done
6. Range Low	n bytes	Lowest legitimate value the field may have
7. Range High	n bytes	Highest legitimate value the field may have

*Hexadecimal FF means that the preceding field was the last in the record.

**Hexadecimal FF means that the preceding criteria was the last for this field.

comes during the actual editing of the data (step 3), and finally, Field Length is used when the good data is to be moved to its position in the output record (step 5).

The fourth item in the table is Output Location. This information is used when the validated data is moved into the output record storage area (step 5 in Flowchart 4).

The fifth item in the Field Descriptor Table is Edit Criteria. This one-byte field tells the edit driver program which of the edit routines to call at this particular point. For example, if Edit Criteria contains a value of one, it could mean to perform a numeric check on this data item. A two might mean a range check. In the case of a range check, items six and seven in the FDT will also be used. Item six is the lowest allowed value, and item seven is the highest. These two items would only be used when a range check is indicated. If Edit Criteria contains a hexadecimal FF, the program will know that the last edit has been performed on the data item and that it is time to move the field into the output area.

SUMMARY

You should find it a fairly simple task to write such a system for your own use using the flowcharts and text of this article. In writing the system, you should note that each edit routine must be designed to operate with the information in the FDT. They must also all return a set of standard codes (which you define) to the driver to tell it exactly what is wrong, if anything, with the data.

This standardization will have several benefits. First and perhaps most important, it will make it easy to add more edit routines should they become necessary. Second, using a table driven system allows you to use the same system with many different types of data and applications. All that is needed is to load a different FDT and you're ready to edit payroll data, or inventory data, or whatever other systems you run.

Finally, a segmented approach makes it easy to locate bugs in the system. This doesn't sound like much at first, but if you think for a moment, you'll realize that it is impossible to prove that there are no errors in a program. In a large system, errors are often discovered after months or even years of operation. If all your programs are built using segmented logic and other techniques of modern programming, you will find that your data processing effort will run more smoothly and with fewer errors.☐

CARD-OF-THE-MONTH

Vector Graphic Inc. PROM/RAM Board

An Easy Storage for Overhead Programs

By Roger H. Edelson, Hardware Editor

A quick overview of the PROM/RAM board is necessary before the construction and design details are discussed. This board basically is a combined S-100 compatible RAM and PROM memory board. Space for 2K bytes of PROM is provided by having room for eight 1702A PROM chips. It is unfortunate that the board was designed before the more popular (and usable) 2708 chip appeared on the scene. With the 2708 there would be space for 8K of PROM, and the chip could be programmed in your computer (using another vendor's board).

The PROM/RAM board provides 1K of low power, 450 ns. access time RAM memory basically for use as stack storage. This removes the inconvenience of having to reprogram the PROMs to relocate the stack whenever more memory is added to the system. The slow speed of the RAM devices may be some problem if the higher speed 4MHz MPUs are being used, but faster chips are available.

To make the board more useful than just a combined PROM-RAM memory, Vector Graphic has provided circuitry to replace the front panel write logic. This feature coupled with the optional 512 byte Monitor Program provides the user with a completely operational system without the need for a front panel and its switches. Vector Graphic has also provided Jump-On-Reset circuitry which allows a program in PROM to be executed starting at any location in memory without interfering with programs in other portions of memory.

The kit itself is very simple and should require no more than an hour or two to construct. Sockets are provided for all the ICs, and the installation of these parts occupies the bulk of the construction time.

The board is constructed of quality G-10 glass-epoxy with plated through holes. Solder masking is provided on both sides of the board and is of very high quality; each socket pad is isolated. This extensive masking makes it difficult indeed to inadvertently short two pins. The silk-screen parts identification is also very well done and quite readable. It is possible to assemble the entire board without reference to a layout drawing.

This month features the Vector Graphic Inc. PROM/RAM board which provides a low-cost home for those much needed overhead driver programs. When combined with the optional firmware pre-programmed into 1702 PROMs, this board will provide a firmware substitute for a front panel. In this respect the PROM/RAM board differs from the full front-panel replacement board reported on in a previous month's article.

The assembly instructions are very good — generally a cut above the normal computer kit instructions. Adequate pictures and text are provided so that even the beginner can confidently approach the construction of the PROM/RAM board. All the parts appear to be of a high quality consistent with top of the line kits; the sockets and the edge connectors are gold-plated for reliability.

I do have one very minor quibble: the board address location circuitry is patched to the desired location through soldered jumper wires and a dip switch is shown as a user option. With all the nice thought in the construction and design of the board it would have been consistent if Vector had provided the switch. If not a switch, at least those ubiquitous jumper pins provided in other kits.

Though the board only provides 3K of memory, it occupies 4K of memory space. This was done to simplify the addressing; it is only necessary to decode lines A12 through A15 to enable the board. A Quad-Exclusive OR gate is used to allow user selection of the board address location. If the optional DIP switch (or solder jumper wires) is used, the Exclusive OR function will act to invert the address lines if the contacts (gate inputs) are open.

The same scheme is also operational if no changes are made to the board, but the addressing has been prejumpered (through the use of pc traces) for address space C000-CFFF. The user is also provided with a selectable number of wait states to the MPU. The Board Enable Signal is gated with PDBIN and SMER to activate the bus drivers, thus placing data from the PROM or RAM on the Data In Bus.

Address lines A0-A7 are connected to both the PROM and RAM. A8 and A9 are also connected to the RAM which has 1024 locations. But since the PROMs have only 256 addressable locations, the 74LS42 is used to select one of eight chips covering the entire 2K of PROM memory.

Vector Graphic did not feel it was necessary to buffer the address lines since the number of chips is considerably less than found on a standard 8K memory board, and there would rarely be more than one of these PROM/RAM boards used in a system. I, however, like all of my address lines and data lines buffered both from a loading point of view and to prevent blowing out the higher priced memory chips (as opposed to the lower priced buffers). However, I can see Vector Graphic's point, and it does save some money.

The Data Out Bus is connected directly to the Data In pins of the appropriate RAM chip. No connections are made to the PROM Data In pins because this board does not provide the facilities for programming the 1702s.

The Jump-On-Reset feature is controlled by the Jump flip-flop produced by cross coupling two NAND gates. When the PRESET line goes low, the board is enabled regardless of the state of the address lines. At the same time, the PHANTOM line goes low and is used to disable the memory output bus drivers of the Vector Graphic 8K memory boards — if their output disable jumper is in place. If this feature is to be used with other memories, similar disable circuitry must be included on those boards or this scheme will not work.

Since PRESET causes the MPU to zero the Program Counter, program execution will begin at location 0000 when the PRESET line goes high. As the only memory that is enabled is the PROM/RAM board, the fetched instruction will be the one stored at the first location in page 0 of the PROM. This instruction should be JMP X003, where X corresponds to the selected address of the PROM/RAM board.

Response to this instruction causes the MPU to substitute X003 in the Program Counter and fetch the next instruction from this location. This is, of course, the next instruction in the PROM, and when this address is decoded, the circuitry will reset the Jump flip-flop. Normal operation of the PROM/RAM board and the other memory bus drivers is now restored, and the program execution continues in PROM at the normal address for which the program is assembled.

This jump technique does not interfere with the program stored in RAM at location 0000 since RAM is not enabled and its contents are not read. This type of Jump-On-Reset technique is not restricted to a particular op code set like the usual hardwired JAM techniques. If a different type of microprocessor than the 8080 or Z-80 is to be used, the PROM can be reprogrammed to contain the correct op codes.

The manual devotes about a page to trouble shooting hints and a discussion of an 8080 machine language memory test program as it relates to board errors. Because this is a very simple board, the discussion is adequate for almost any problem that is likely to be experienced.

The 512 byte monitor, though small, does contain sufficient programs to get you up and running. Included are ASCII and HEX memory dump, a Go To command, a Load from Tarbell cassette, Read and Write Tarbell cassette commands, Verify Tape and Test memory commands, and a Program memory from terminal command.

The PROM/RAM board is very good for those installations which have a keyboard or terminal input device and have no need for front panel switches. The design provides some very nice touches and the kit is easy to assemble, reasonably priced, nicely thought out, and of generally high quality. □

CIRCLE INQUIRY NO. 95

CIRCLE INQUIRY NO. 68

Building An Inexpensive 2708 EPROM Programmer

By Darrel J. Van Buer

INTRODUCTION

With the current price war for 2708 erasable programmable read-only memories (EPROMs), they have become one of the most cost-effective EPROMs available. With this sharp drop in price from $75 a few years ago to $15 or less today, the programming cost has become an important element in the cost of using them. Commercial programming services often charge $10 to $20 to program one PROM. Most PROM programmers cost well over $100. This is a bit high, too. Many of the more expensive programmers have features desirable for production programming operations but are hardly needed for programming an occasional EPROM.

With the right software, nearly all the requirements for programming a 2708 can be directly controlled by a microprocessor with a few thousand bytes of memory and fewer than two dozen parallel I/O lines. The remaining requirements can be met by an inexpensive 26 volt power supply, 26 volt pulse shaping circuitry and a 12 volt write enable driver. It is also possible to reduce the number of I/O lines needed by adding one more IC to the programmer.

Figure 1 shows the relevant waveform timing restrictions when programming a 2708 EPROM. From debugging my circuit and software, I can attest that all the requirements must be met to correctly program data into the PROM. Intel is quite specific in stating that addresses must be cycled in sequence with program pulses as specified, or the PROM may be damaged. By placing program pulse control in hardware, no PROM damage can result if the computer errs, halts or is reset.

HARDWARE

The circuitry needed is shown in Figure 2. Pin 2 of IC A (7406) and the associated resistors drive the $\overline{CS}$/WE input of the 2708 high (+12 volts) for programming and low for readout. One half of IC B (74123) is used to provide the required data setup to program pulse delay of 10 microseconds. The other half of IC B generates the required program pulse, nominally 1 millisecond.

The output of this stage drives the network of drivers, transistors and resistors which controls application of the 26 volt programming pulse to the PROM. In addition, the trailing edge of the pulse signals the end of a programming step to the I/O port handshaking input. The stage also drives an LED which lights during pulse generation. Presuming the 26 volt power supply is turned on, the LED indicates programming is occurring.

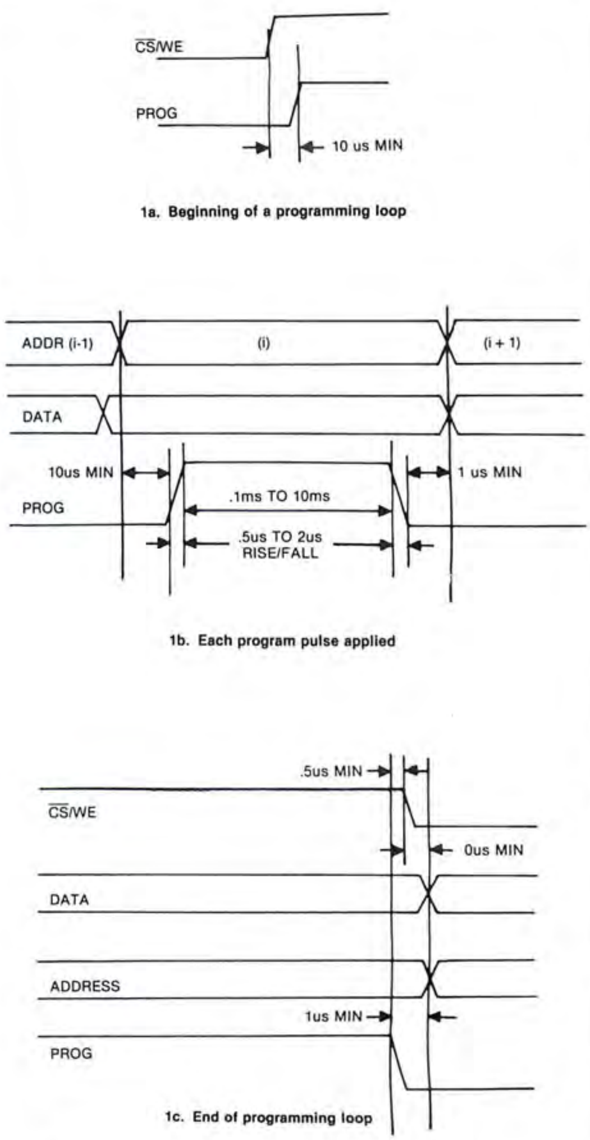


Figure 1. Critical Programming Waveforms

PARTS LIST

IC A — 7406 O.C. inverter
IC B — 74123 dual one-shot
IC C — 2708 EPROM
IC D — LM340T-24
C1 — 0.001 uF
C2 — 0.1 uF
C3 — 0.004 uF
C4 — 1000 uF, 50v electrolytic
D1, D2, D3, D4 — 1N4001
D5, D6 — 1N914
D7 — Red LED
R1 — 2.2K ohm
R2 — 6.8K ohm
R3 — 100 ohm
R4 — 47K ohm
R5 — 33K ohm
R6 — 3.3K ohm
R7, R10 — 10K ohm
R8, R9 — 50 ohm
R11 — 330 ohm
Q1 — 2N2907
Q2 — 2N2222
T1 — 30v C.T. at 40 ma
24 pin socket for EPROM
Optionally, sockets for other ICs, parts and I/O port connection

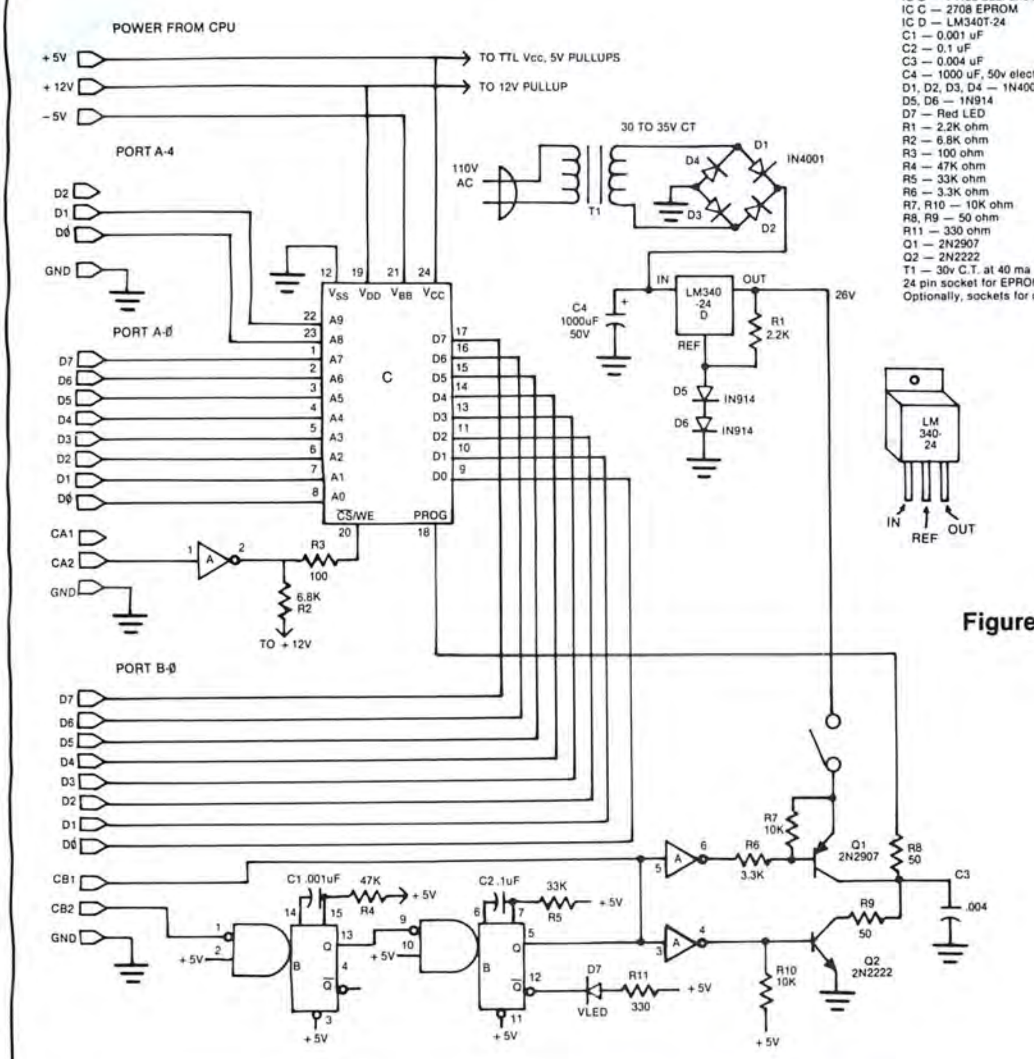


Figure 2. Circuit Diagram

Most of the power for the ICs in the circuit is taken from the computer doing the programming since +5 volts, +12 volts and −5 volts must be present to use the PROM. Because +26 volts is not available in most computers, a separate power supply must be provided. As less than 50 milliamps are required, any small transformer with an output from 26 volts to 36 volts can be used. Manufacturers don't make 26 volt regulator ICs, so I used a 24 volt regulator and raised its output two volts by connecting the reference terminal to a voltage divider made of a resistor and two forward biased diodes. The cost of building the programmer with wire-wrap methods on perf board is about $25. There are also a few similar commercial units in the $30 range (not including a 26 volt power supply).

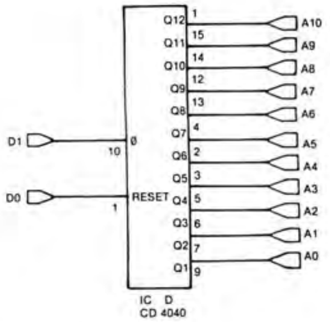


Figure 3. Optional Counter Circuit

Figure 3 shows an additional circuit element which can be added to the programmer. This circuit reduces the number of output address lines to two instead of 10 or 11. Since normal programming and verification is done in sequential address order, it is just as effective to step a counter one step. For some of the newer PROMs, which can be programmed partially or in random order, this is less convenient, but well suited to the 2708. To change addresses with this circuit, two consecutive output commands are needed to first set, then reset the appropriate bit to cycle 0 or RESET.

The I/O requirements for this programmer are ten output lines for the PROM address (two with the optional counter), one output line for $\overline{CS}$/WE control, eight switchable input/output lines to read and write PROM data, with one pair of handshaking lines for the program pulse during write.

Because all the address and data lines of the PROM are only 10 microamp TTL compatible loads, MOS/LSI parallel I/O chips like the Motorola MC6820 and the Intel C8255 are especially well suited for this use. Their data lines are bidirectional under program control, and they have handshaking lines as well. The use of less sophisticated I/O chips (like Intel 8212s) is also possible, but their lack of versatility requires either manual switching between programming and verifying modes or adding extra circuitry to implement bidirectionality and handshaking.

PROGRAMMING

The programming example discussed below is based on the use of two Motorola MC6820 ICs (used, for example, on MITS Altair® 8800 4-PIO board and for the parallel ports of the 680-UIO board) without the optional counter in an 8080-based system. Table 1 lists the correspondence between the I/O lines of the MC6820s used and their function connected to the programmer. One extra line has been defined as an eleventh address bit (A10) for future expansion to the new generation of 2716 EPROMs. Table 2 shows the suggested correspondence between the lines of these two MC6820s and the lines of a single Intel 8255 (used, for example on the IMSAI PIO-6 board and on Intel single board computers).

The PROM programming program directly controls most of the signals applied to the 2708, so the majority of waveform specifications given on the 2708 data sheet are reflected in the sequence in which signals are generated in the program.

There are three major phases to the programming process: initialization, PROM writing, and PROM verification. Figure 4 is the flow diagram for the overall program flow. For correct operation as written, the data in computer memory must be on a 1024-byte boundary. Note that the loop is shown as being done 100 times. Each pass through the loop performs one programming cycle of all 1024 addresses. The actual number of loops required varies with the length of the actual program

Table 1. Connections Between PROM Programmer and MC6820 PIAs

PIA SIGNAL	PROGRAMMER CONNECTION
(First PIA)	
PA7	Addr A7
PA6	Addr A6
PA5	Addr A5
PA4	Addr A4
PA3	Addr A3
PA2	Addr A2
PA1	Addr A1
PA0	Addr A0
CA2	CS/WE control
PB7	Data I/O D7
PB6	Data I/O D6
PB5	Data I/O D5
PB4	Data I/O D4
PB3	Data I/O D3
PB2	Data I/O D2
PB1	Data I/O D1
PB0	Data I/O D0
CB1	Cycle end signal
CB2	Cycle start signal
(Second PIA)	
PA2	Addr A10 (spare for 2716s)
PA1	Addr A9
PA0	Addr A8

Table 2. Signal Correspondence between Peripheral Interface Adapters (MC6820 PIA) and a Programmable Peripheral Interface (8255 PPI)

MC6820 Pin	PIA LINE Name	8255 Pin	PPI LINE Name
(First PIA)			
9	PA7	25	PB7
8	PA6	24	PB6
7	PA5	23	PB5
6	PA4	22	PB4
5	PA3	21	PB3
4	PA2	20	PB2
3	PA1	19	PB1
2	PA0	18	PB0
17	PB7	37	PA7
16	PB6	38	PA6
15	PB5	39	PA5
14	PB4	40	PA4
13	PB3	1	PA3
12	PB2	2	PA2
11	PB1	3	PA1
10	PB0	4	PA0
39	CA2	13	PC4
18	CB1	11	PC6
19	CB2	10	PC7
(Second PIA)			
4	PA2	16	PC2
3	PA1	15	PC1
2	PA0	14	PC0

CONTROL WORD CORRESPONDENCE

MC6820 CONTROL WORDS		8255 CONTROL WORDS	
	INITIAL AND VERIFICATION MODE		
Register	**Set value to**	**Register**	**Set value to**
(First PIA)			
DDR-A	OFFH	Control	90H
DDR-B	00H	Control	09H (Bit set-C4)
Control-A	3CH		
Control-B	2CH		
(Second PIA)			
DDR-A	OFFH		
	PROGRAM MODE DIFFERENCES		
(First PIA)			
DDR-B	OFFH	Control	0A0H
Control-A	34H	Control	08H (Bit clear C4)

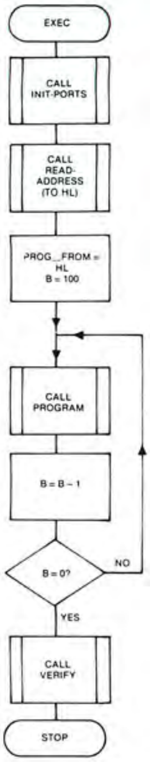


Figure 4.

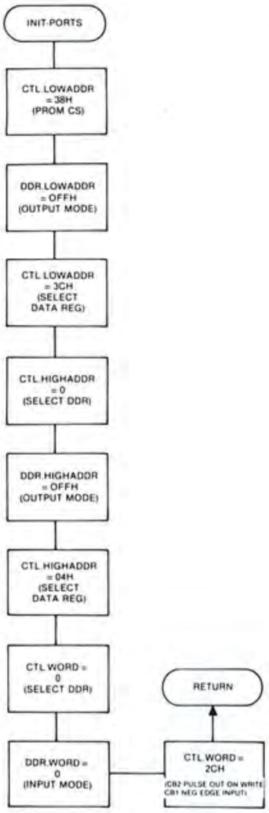


Figure 5.

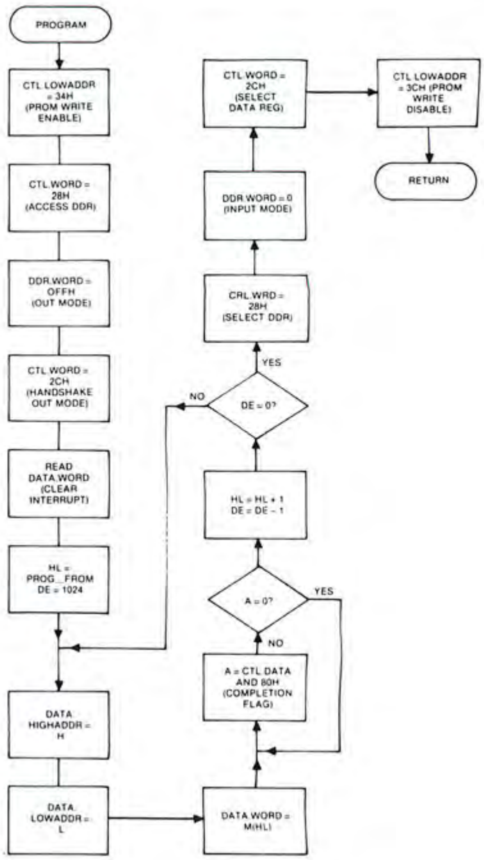


Figure 6.

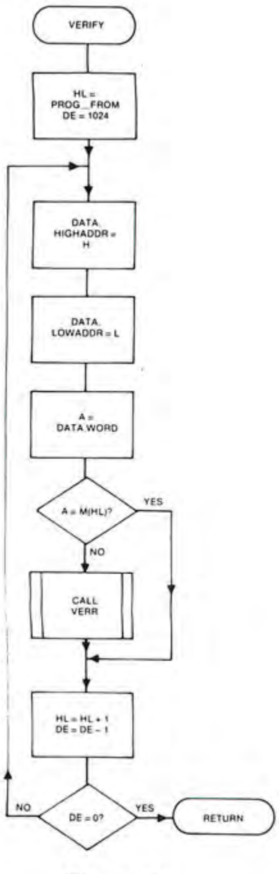


Figure 7.

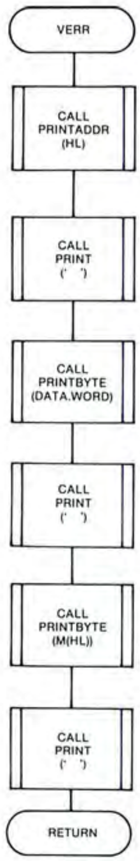


Figure 8.

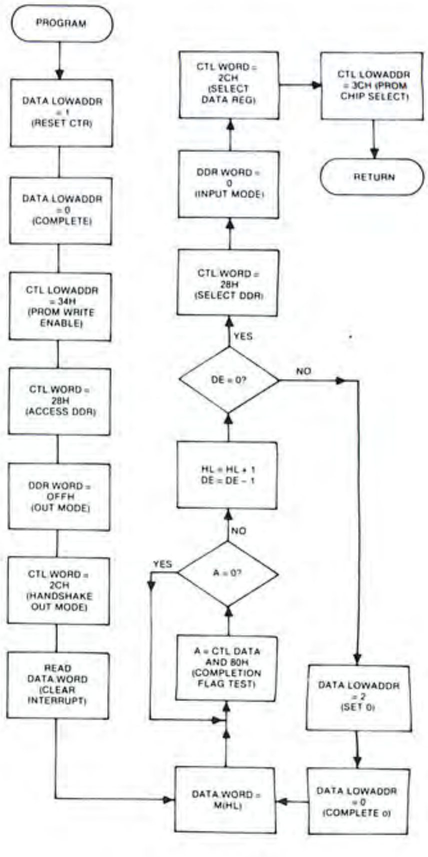


Figure 9.

pulse. The actual number of loops may be as high as 1000. Intel specifies that the product pulse length and the number of loops must be at least 100 milliseconds.

If equipment to measure the actual program pulse length is not available, it can be approximated by adjusting the full programming operation to take about 2 minutes. Extra cycles will not harm the 2708, but too few cycles may result in unsuccessful programming, so it pays to be generous. While not reflected in the flowchart, it may be necessary to add about thirty seconds of delay between the programming and verification phase to allow the PROM to cool, as the data reads are less reliable hot.

Figure 5 is the flow diagram for INIT-PORTS which initializes the I/O ports for the MC6820 I/O chips used. For other kinds of ports, the control register and bit definitions would differ but should have the same effect. Table 2 provides a guide to the changes in this initialization for the Intel 8255. Initialization should be performed before inserting the PROM.

Figure 6 diagrams the main programming loop which makes one pass through the PROM. The first five and the last four steps in the flow chart perform the operations needed to put the programmer into and out of the write mode. This involves both changing the value of CS/WE line and changing the direction of the data I/O lines. Table 2 provides guidance for converting these steps to use with an 8255.

The outer of the two nested loops outputs the next address and data to be programmed and advances the addresses and counts involved. The inner loop waits on the handshaking input from the programmer to signal the end of the program pulse started by the data output step. The outer loop is performed 1024 times, the number of bytes in the PROM.

Figure 9 shows the modified flow chart to perform the programming operation with the optional counter circuit. It is basically similar, but it is important that the step to increment the counter be located as it is. One of the programming specifications (shown in Figure 1c) requires that write enable end before the address of the last word programmed changes, so the termination test must be made before the counter is incremented.

The result of programming is verified by the routine diagrammed in Figure 7. In some ways, it parallels the structure of the programming routine. It also cycles through all 1024 consecutive addresses, but instead reads in the PROM word. The input is then compared with the memory location from which it was programmed. If the results differ, it calls VERR, which is diagrammed in Figure 8. VERR is simply a routine to report the address, the correct data and the actual data for the PROM. VERR assumes system routines are available to print addresses and data bytes at the terminal in HEX or octal, as may be customary in your system. Program 1 is an 8080 assembler language implementation of the routine diagrammed in Figures 4 through 8, which I have run on my system in a slightly different form.

USING THE PROGRAMMER

To actually use the programmer once it's built, the first step is to connect the programmer to the appropriate I/O ports, make all power connections, and load the programming software into memory. The next step is to load memory with the data to be programmed. This might be done by an assembler or compiler, a data table generated by BASIC, or even from a master PROM read in through the PROM programmer by a program similar to VERIFY.

At this point, call the main program EXEC to initialize the programmer ports and insert the PROM in the programmer socket. Be sure pin 1 of the PROM and its socket are aligned. Turn on the 26 volt power supply and

give the starting address to let the programming software start. The indicator LED should remain lit for about two minutes, and the PROM will get fairly warm. After the LED goes out, either the program will print a list of misprogrammed addresses or return to the monitor program which called it. Because VERIFY is written as a subroutine, it can also be called to double-check the contents of a PROM. Once the PROM is verified, turn off the 26 volt power supply and remove the newly programmed PROM.

PROGRAMMING OTHER PROMS

2704 PROMs are virtually identical to 2708s except for capacity. The only difference needed is to change the loops in PROGRAM and VERIFY from 1024 to 512 steps. The data in memory should be on a 1024 byte boundary to keep address bit A9 at 0 as required.

Both Intel and Texas Instruments are making 16384 bit 2716 EPROMs which are different from each other and from the standard pinouts for 2708s. At this time, both cost considerably more than 2708s, and there is some uncertainty as to which version the rest of the industry will follow.

The TI version is very much like two 2708s in one package, so this programmer should be able to program them by simply rearranging a few lines in the circuit and doubling the loops counts in software.

The Intel 2716 programs are considerably different from 2708s. The only feature in common is that, like this programmer for 2708s, most of its inputs can be directly controlled by computer output ports with a small amount of other circuitry.

Older types of EPROMs such as 1702s, 8702s, MM5203s and MM5204s cannot be programmed by such a simple programmer due to non-TTL logic levels used during programming, combined with a fairly complex series of demanding waveform changes.☐

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PROGRAM LISTING

```
2000 CD 16 20           CALL  INPRT
2003 CD 0F F0     EXEC  CALL  RDNUM
2006              RDNUM EQU   0F00FH
2006 22 B9 20           SHLD  PROGF
2009 06 6B              MVI   B,107     $LOOPS
200B CD 3B 20     PLOOP CALL  PROG
200E 05                 DCR   B
200F C2 0B 20           JNZ   PLOOP
2012 CD 82 20           CALL  VERI
2015 C9                 RET
2016 3E 04        INPRT MVI   A,04H     DATA REG
2018              DATA  EQU   23H
2018              CTDAT EQU   DATA-1
2018              LADDR EQU   DATA-2
2018              CTLAD EQU   LADDR-1
2018              HADDR EQU   25H
2018              CTHAD EQU   HADDR-1
2018 3E 38              MVI   A,38H     CA2-OUT-1,DDR
201A D3 20              OUT   CTLAD
201C 3E FF              MVI   A,0FFH    ALL OUT
201E D3 21              OUT   LADDR
2020 3E 3C              MVI   A,3CH     DATA REG
2022 D3 20              OUT   CTLAD
2024 3E 00              MVI   A,0       DDR
2026 D3 24              OUT   CTHAD
2028 3E FF              MVI   A,0FFH    ALL OUT
202A D3 25              OUT   HADDR
202C 3E 04              MVI   A,04H     DATA REG
202E D3 20              OUT   CTLAD
2030 3E 00              MVI   A,0       DDR
2032 D3 22              OUT   CTDAT
2034 D3 23              OUT   DATA      DDR TO INPUT
2036 3E 2C              MVI   A,2CH     CB2-PULSE OUT, CB1 FALL IN
2038 D3 22              OUT   CTDAT
203A C9                 RET
203B              * CHANGE READ TO WRITE MODE
203B 3E 34        PROG  MVI   A,34H
203D D3 20              OUT   CTLAD
203F              *CHANGE DDR TO OUT
203F 3E 28              MVI   A,28H     DDR
2041 D3 22              OUT   CTDAT
2043 3E FF              MVI   A,0FFH    ALL OUT
2045 D3 23              OUT   DATA
2047 3E 2C              MVI   A,2CH     DATA REG
2049 D3 22              OUT   CTDAT
204B DB 23              IN    DATA      CLEAR INT
204D              *PROGRAMMING LOOP (1K BOUND)
204D 2A B9 20           LHLD  PROGF
2050 11 00 04           LXI   D,400H    1K BYTE COUNT
2053 7C           LOOP  MOV   A,H
2054 D3 25              OUT   HADDR     PROM ADDR
2056 7D                 MOV   A,L
2057 D3 21              OUT   LADDR
2059 7E                 MOV   A,M
205A D3 23              OUT   DATA      START WRITE PULSE
205C 00                 NOP
205D 00                 NOP
205E 00                 NOP             ALLOW FOR PROG PULSE DELAY
205F DB 22        WPP   IN    CTDAT
2061 E6 80              ANI   80H       WAIT FOR HANDSHAKE
2063 CA 5F 20           JZ    WPP
2066 DB 23              IN    DATA      CLEAR INTERRUPT
2068 23                 INX   H
2069 1D                 DCR   E
206A C2 53 20           JNZ   LOOP
206D 15                 DCR   D
206E C2 53 20           JNZ   LOOP
2071              * RESTORE READ MODE
2071 3E 28              MVI   A,28H     DDR
2073 D3 22              OUT   CTDAT
2075 3E 00              MVI   A,0       INPUT
2077 D3 23              OUT   DATA
2079 3E 2C              MVI   A,2CH     DATA REG
207B D3 22              OUT   CTDAT
207D 3E 3C              MVI   A,3CH
207F D3 20              OUT   CTLAD
2081 C9                 RET
2082 2A B9 20     VERI  LHLD  PROGF
2085 11 00 04           LXI   D,400H
2088 7C           LOOPV MOV   A,H       ADDR
2089 D3 25              OUT   HADDR
208B 7D                 MOV   A,L
208C D3 21              OUT   LADDR
208E DB 23              IN    DATA
2090 BE                 CMP   M
2091 C4 9E 20           CNZ   VERR      NOT EQUAL
2094 23                 INX   H
2095 1D                 DCR   E
2096 C2 88 20           JNZ   LOOPV
2099 15                 DCR   D
209A C2 88 20           JNZ   LOOPV
209D C9                 RET
209E CD 1B F0     VERR  CALL  WXHL
20A1 3E 20              MVI   A,"       "
20A3 CD 09 F0           CALL  WRCHR
20A6              WRCHR EQU   0F009H
20A6              WXHL  EQU   0F01BH
20A6              WXA   EQU   0F013H
20A6 DB 23              IN    DATA
20A8 CD 13 F0           CALL  WXA
20AB 3E 20              MVI   A,"       "
20AD CD 09 F0           CALL  WRCHR
20B0 7E                 MOV   A,M
20B1 CD 13 F0           CALL  WXA
20B4 3E 20              MVI   A,"       "
20B6 C3 09 F0           JMP   WRCHR
20B9 00 00        PROGF DW    0         POINTER TO DATA
```

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PEACE

A Review of the Heath H11

The H11 16-bit microcomputer has excellent growth potential because of its flexibility and the inherent advantage of the 16-bit microprocessor over today's common 8-bit microprocessors. However, much depends upon the viability of the S-100 bus and the impact of the new 16-bit microprocessors offered by Intel, Zilog and Motorola.

Combined with the expansion modules produced by the Digital Equipment Corporation, the H11 offers much to the small business, scientific and educational markets. However, it may well be too expensive for the home computer enthusiasts.

In any case, the potential of the H11 cannot be realized until the H27 floppy disk system replaces the H10 paper tape reader/punch. The H11 can best be viewed as a vehicle for growth into the 1980's — the decade of the microcomputer.

Last summer's introduction of the H11 16-bit microcomputer must have surprised a good many computer enthusiasts, amateur and professional alike. This system combined the well known Heathkit™ expertise in the production of high quality kit products with the Digital Equipment Corporation's technical excellence in the commercial computer market. Heath Company is the world's largest manufacturer of electronic kits, with annual sales in the neighborhood of $100 million. Digital, (DEC™), is by far the largest producer of small, medium and large scale minicomputer systems, with their PDP-8™ and PDP-11™ products generating billions in revenues.

GROWTH POTENTIAL

You may be familiar with some of the more common 8-bit microcomputers based on the 8080A, Z80, 6800 and 6502 microprocessors. Since these machines do a fairly adequate job of running BASIC programs, you may wonder how the H11 could offer any advantages to justify its rather high cost. After all, the basic microcomputer with cabinet, power supply and four kilowords, (4KW), of RAM costs $1,295.00, including software. Perhaps your curiosity can best be satisfied in terms of the potential for future expansion of the H11 system.

There can be no doubt that many educators, small businesspersons and other progressive individuals have become aware of the microcomputer. Some of the more useful applications lie in the areas of computer aided instruction (CAI), text editing, accounting, record keeping and home management. To be cost effective, a computer system must be fitted to its job. Small systems are appropriate for small jobs, and larger systems are more effective in the more sophisticated applications. Possibly today's 8-bit microprocessor is better suited to less ambitious uses, such as games, computer trainers, simple graphics systems and digital controllers. Actually, the 8-bit machine can perform many complex tasks, but the 16-bit processor has distinct advantages which allow it to function with greater speed and efficiency in the more sophisticated applications.

WORD = BYTE * 2.0;

The most obvious difference between 8-bit and 16-bit processors is that the former processes 8-bit address objects called "bytes" while the latter group handles 16-bit quantities called "words". The capability to process larger units gives a 16-bit machine a decided advantage over smaller machines, at least for many data processing applications. In areas where cost is of primary importance and performance is only a secondary consideration, the advantage may not be so clear. Ex-

# of Microcomputer

By Barry A. Andrews

amples are the control of cash registers and household appliances, where even 4-bit processors find a home.

In many data processing applications, large binary numbers must be manipulated, or multiple bytes must be transferred between two data areas as rapidly as possible. The old cliche, "Time is money," is very fitting, especially in business applications. Here, the larger machine has an edge as long as other factors such as cycle time and memory speed are equal.

A byte can represent a numerical quantity as large as 256. Since a word is composed of two bytes, more combinations of bits are available. Thus, a 16-bit word can represent a quantity as large as 2^{16} or 65,536. This fact yields the single major advantage of the 16-bit processor over its 8-bit cousin.

More bits imply that more combinations of events can be controlled simultaneously. Stated differently, more bits means a greater number of options are available within the same time frame to the processor with the wider data path. As an example, Figure 1 illustrates the steps required to add the contents of a memory location to the contents of another memory location, with the sum remaining in the second location.

(a)	(b)
LDA NUM1 LXI H, NUM2 ADD M MOV M, A	ADD NUM1, NUM2
The sequence for the 8080A.	The single H11 instruction.

Figure 1. Comparison of memory-to-memory ADD operations. (a) The sequence for the 8080A. (b) The single H11 instruction.

The assembly language instructions on the left represent the steps taken by a microcomputer based on the 8080A. For an 8080A-2, which is a slightly speeded-up version of the standard 8080A, the sequence takes about 14 microseconds and requires eight bytes of machine code. Six bytes of code and about 12.6 microseconds suffice for the H11 which requires only the single assembly language instruction on the right.

It should be noted that the sequence shown for the 8080A results in the destruction of the previous contents of the accumulator and the HL register pair, while the H11 performs the operation directly on the two memory locations. Another consideration is that the 8080-based microcomputer adds only two 8-bit bytes, while the H11 adds two 16-bit words. The time and memory differentials would be far greater if two 16-bit quantities were added non-destructively in both cases.

Such examples in no way represent an upper limit on the performance of the 8-bit microprocessor. An 8-bit machine constructed using bipolar TTL parts would undoubtedly blow the doors off the rather slow H11. An 8080A can perform several operations faster than the H11's LSI-11™ processor. For example, if both machines were used only to add bytes, then the 8080-based microcomputer would have a slight advantage. The point is that the results of timing comparisons are highly dependent on the particular operation performed. Other factors such as cycle time, memory speed, the number of available machine instructions, the number and type of internal registers and the variety of addressing modes play an important role in computer performance.

In general, the well designed 16-bit processor is superior to a technologically equivalent 8-bit processor in several of these areas. Since the larger 16-bit address object provides more combinations or options in a single instruction, it usually has greater flexibility which can be translated into higher performance. Although the LSI-11 processor in the H11 is not the newest or fastest 16-bit microprocessor, it provides an excellent example of this general characteristic of architectural flexibility.

The introduction of the LSI-11 in 1975 represents the first entry of a major computer manufacturer into the

microcomputer market. Its internal architecture has much in common with the famous PDP-11 series of minicomputers. In general, it has the same set of eight 16-bit general purpose registers, the same stack oriented organization and the same powerful instruction set of such machines as the PDP-11/40™. The major differences are its NMOS LSI fabrication as opposed to the faster TTL SSI/MSI technology, its smaller 32KW addressing range, and the absence of advanced system features such as memory management and fairly large hard-disk operating systems. Thus, the LSI-11 resides at the low end of the DEC computer spectrum.

Nine internal registers are directly accessible to the H11 machine/assembly language programmer. These are the six general purpose registers, (R0-R5), the stack pointer register, (R6), the program counter, (R7), and the processor status word, (PSW). Refer to Figure 2 for a diagram of the internal register structure. The general registers provide a great deal of flexibility since they can all be used as accumulators or index registers. The stack pointer

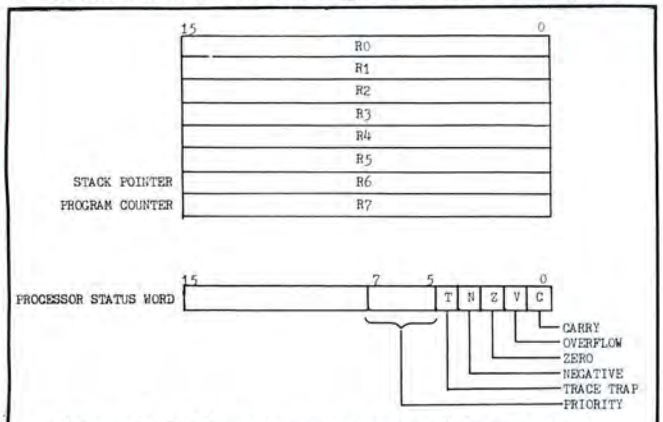


Figure 2. H11 programmer accessible registers.

register and program counter are logically equivalent to the other six, except they are dedicated to specific hardware functions. All eight registers in this file can be used to address operands in a very consistent manner by means of the many H11 addressing modes.

Eight basic addressing modes can be used with the registers other than the program counter. Four of these modes are used with the program counter to obtain additional flexibility. Refer to Figure 3 for a list of addressing modes.

MODE	NAME
0	register
1	register indirect
2	autoincrement
3	autoincrement indirect
4	autodecrement
5	autodecrement indirect
6	indexed
7	indexed indirect

(a) Modes used with registers R0-R6.

MODE	NAME
2	immediate
3	absolute
6	relative
7	relative indirect

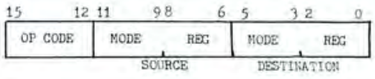
(b) Modes used with the program counter, (R7).

Figure 3. Addressing modes used with the H11. (a) Modes used with registers R0-R6. (b) Modes used with the program counter, (R7).

A reference to an addressing mode combined with a reference to a specific register is used to define an operand or the address of an operand. Operands are combined with operation codes to make up an H11 machine instruction. An operand can either be the source or the destination of the operation specified by a machine instruction. Double operand instructions specify both a source and a destination, while single operand instructions specify one or the other. For example, an ADD instruction is of the double operand type because the contents of the source register, memory location or immediate operand are added to a destination. Figure 4 lists some of the ways in which the ADD instruction can be used. Most of the other instructions in the H11 set are just as flexible. In general, more than 70 operation codes can be combined with the various addressing modes to produce over 400 different machine instructions.

Register to register.
Register to memory.
Memory to register.
Memory to memory.
Immediate to register.
Immediate to memory.

(a) Basic source and destination operands.



(b) ADD instruction format (double operand).

Figure 4. Use of the H11 ADD instruction. (a) Basic source and destination operands. (b) ADD instruction format (double operand).

The basic H11 microcomputer module, known as the KD11-F, is provided fully assembled and tested by DEC. It consists of a single 8.5" x 10" multi-layer printed circuit board with processor, memory, bus interface circuitry and four 36-pin gold-plated edge connectors. Four Western Digital 40-pin LSI IC packages provide the basic CPU functions. A fifth optional IC provides hardware signed multiply and divide, and floating point add, subtract, multiply and divide. A 4KW dynamic RAM array with burst-mode refresh provides the onboard memory.

The four basic processor IC's include a CONTROL chip which translates binary machine instructions into timing and control signals. These signals are utilized by a DATA chip to provide the normal arithmetic and logical CPU functions. The other two IC's are MOS ROM packages, called MICROM's, which contain the microprogram. The sequence in which these MICROM micro-instructions are executed controls the execution of the machine instructions which are stored in external memory.

For $150.00 to $190.00, depending on the source, the fifth IC can be added to the set. This package, called the EIS/FIS chip, is also a MICROM. It should be noted that the Heath high level software does not utilize this IC, depending instead on software multiply and divide and floating point routines to provide extended arithmetic functions. However, the execution of some machine/assembly language arithmetic operations can be speeded up as much as 10 to 100 times when the EIS/FIS chip is used.

The processor runs on a 10 MHz four phase clock, giving a basic cycle time of 400 nanoseconds. This is roughly comparable to a Z80 or a selected 8080A. Since these machines are all fabricated using similar NMOS technology and were introduced at about the same time, it is not surprising that the basic cycle times are approximately equal.

In contrast, the selected version of the new Intel 8086 can run with a basic cycle time of 125 nanoseconds, utilizing HMOS technology. The standard version of the new Zilog Z8000 has a cycle time of 250 nanoseconds and has features which should give it about eight times the throughput of the H11's LSI-11 processor. As another example, the minimum bus cycle time in an H11 is over one microsecond, and the processor is perfectly happy with memory IC's which have access times in excess of

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450 nanoseconds. Thus, the H11 is not an exceptionally fast or sophisticated machine, but it has a very flexible and elegant architecture.

The KD11-F processor module communicates with other modules in the system such as memory boards, serial and parallel interface units or disk controllers by means of a 38-line asynchronous data/address/control bus. The 16 data lines are multiplexed with the address lines to save connections and bus interface circuitry. All bus signals, except two power supply status lines, are low-active open collector levels and are terminated at the processor module. The KD11-F will drive up to six additional modules without extra terminations, and this happens to be the capacity of the H11 backplane/cardguide.

It should be noted that some of the control signals on the Heath designed boards utilize three-state logic levels rather than open collectors, but the bus functionality does not appear to be affected. Some early versions of the Heath serial and parallel interface units also lacked pull-up resistors on the interrupt lines, causing various malfunctions. This problem has now been corrected, but some of the boards will need resistors soldered to the foil side.

The use of an asynchronous bus yields an advantage over most other microcomputer systems, such as those based on the popular S-100 bus. On an asynchronous bus, each module generates a reply signal to indicate to the processor when it has completed an assigned operation, such as a memory read or the transmission of a serial byte. Fast modules reply sooner than slow modules, resulting in less processor waiting time. Asynchronous operation permits each module to function at its fastest reliable speed. Therefore, the processor is not forced to run at the speed of the slowest unit on the bus. Slower, less expensive modules can be intermixed with high performance units on the same bus. A faster processor can be installed when technology improvements dictate, without requiring the modification or replacement of expensive memory boards and specialized interface units. Again, the major advantages of the H11 are flexibility and growth potential.

SYSTEM CONFIGURATION

A computer system is much more than a processor, some memory and a number of switches and idiot lights. It is an integrated combination which is greater than the sum of its parts. The new system such as the PET Computer, the Sol Terminal Computer and the Apple II™ all have provisions for software, a keyboard, a video display and mass storage devices. These and other new systems vary to a great extent. Some are completely integrated, offering all such functions in a single package. Others are distributed to some degree, perhaps taking advantage of a home TV set or a portable cassette recorder.

Heath Company's approach is more conventional; some might call them old fashioned. The H11 system is comprised of at least three separate components. First is the microcomputer itself, which combines a cabinet, a switching power supply, backplane/cardguide, processor module with 4KW of RAM and optional memory and interface units.

The second major component is an ASCII terminal device such as an H9 video terminal or an H36/LA36 DECwriter II, with an interface board. The third unit is a program storage device, presently the H10 paper tape reader/punch, with an H11-2 parallel interface unit.

Like the other microcomputers, a number of accessory modules are available for the H11 system, primarily from DEC. Heath markets a 4KW static memory board, based on the 1K x 4 2114 memory IC, with an access time of 450 nanoseconds. Their H11-5 serial interface unit operates at EIA RS-232C, 20 mA current loop and TTL levels, with selectable baud rate up to 9600 bits/second and selectable word format. The H11-2 parallel interface is used primarily as an H10 controller board. It has two 8-bit ports, the high byte and a low byte. Each port has eight bits of input and eight bits of output, plus handshaking signals. The lines are latched and TTL compatible, with the inputs diode-clamped to + 5.6 volts.

Both the serial and parallel units are interfaced by means of 24-pin nylon connectors mounted on the back panel of the H11. Various adaptation schemes are required to allow equipment other than Heath's to be connected to the H11 since no true standardization is utilized. It should also be noted that the negative swing of the "EIA" levels may be too small in some cases for correct serial operation. This problem can usually be corrected by cutting the foil between the base of Q4 and pin two of IC27, and connecting a jumper between the base of Q4 and pin three of IC27 on the H11-5 serial board. The result is that the basic frequency of the charge-pump negative voltage generator is reduced, increasing the negative voltage to the EIA driver IC.

Heath recently announced another very useful accessory. The H27 single/dual floppy disk system will be available late this year as a prewired product. It may be marketed as a kit at some later date.

The H27 will interface to any LSI-11 bus computer system by means of a single 5" x 8.5" controller/bootstrap board. It will reportedly use Memorex™ drives and will be supplied with the HDOS single user operating system. HDOS is very similar in its command syntax to the DEC RT-11 operating system which will also run on the H27 and is probably superior to the popular CP/M system. RT-11 will probably not be available from Heath Company since DEC currently turns a tidy profit by licensing the software at around $1,000.00 per customer. According to the information dispensed at the Second Annual West Coast Computer Faire, Heath plans to market the H27/HDOS system (with dual drives) at around $1,850.00.

The LSI-11 architecture is unique in that a sophisticated ASCII monitor is supported directly by the processor microcode. This monitor, called μODT (Micro Octal Debugging Technique), can be used to bootstrap the system or enter machine language programs directly from the console terminal. In fact, the H11 can be started only in this manner since it has no data/address switches or LED readouts. Therefore, an H11-5 serial board and a terminal are required to use the H11 as a stand-alone microcomputer. Similar functions are provided by the ROM monitors of many other microcomputers, but μODT requires none of the H11's memory space.

Two terminal options are currently available from Heath Company. The H9 video terminal is designed to function at EIA RS-232C, 20 mA current loop or TTL levels. It displays 12 lines of 80 upper case ASCII characters. At $530.00 it is the least expensive video terminal on the market. However, it is a complicated kit, requiring about 35 hours for assembly. It is not recommended for beginners because of its complexity and the resulting opportunities for malfunctions.

The H9 has some weaknesses which should be noted; after all, it is at the low end of the video terminal market. First, the keyboard is fabricated with individual spring-loaded switches which are spaced differently from the keys on a standard typewriter. Also missing is the crisp feel of a standard keyboard. As a result, it is nearly impossible to touch type on this machine. Second, the CRT display blanks out when data is transmitted to the H9 at a rate greater than 600 baud. Apparently, the CRT refresh circuitry is too slow to maintain synchronization. Third, lower case character inputs are displayed as "garbage" rather than as the appropriate lower or upper case character. Lower case inputs literally drive the H9

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bananas. Fourth, the quality of the CRT display leaves something to be desired, depending upon the individual unit. Many H9's display curved lines, jittery characters, or lines which are poorly focused near the edges of the screen. Fifth, a 9-pin nylon connector is used to connect the H9 to a 5-conductor interface cable. Terminals generally use a 25-pin male "D" connector, at least for RS-232C interfacing.

In contrast, the H36/LA36 DECwriter II is a professional hardcopy terminal, manufactured by DEC and distributed by Heath Company. Its excellent quality is reflected in its price tag: about $1,500.00. Heath's price on the LA36 is about $750.00 less than the list price and is even lower than the used price from many distributors. The DECwriter accepts variable width tractor-fed business forms with up to 132 standard columns. Baud rate selections are 110, 150 and 300, with guaranteed 30 characters per second throughput. An optional APL character set and many accessories are available but not from Heath Company. However, they do offer the H36-3 acoustical coupler for telephone data transmission. This option allows a telephone handset to be plugged into the DECwriter.

Since the purpose of any computer system is the running of programs, some method of getting the software into the machine is required. Short machine language programs can be entered and run on the H11 by means of the μODT facilities, but this method is obviously impractical for most serious applications. Heath Company offers the H10 paper tape reader/punch as the sole method of loading and dumping programs and data with the H11. System software is supplied by Heath on fanfold paper tape. It is fed through a channel and slot arrangement on top of the H10. The H11 is instructed to start and control the reader by means of μODT routines.

Usually the tape feeds through the reader with no trouble. However, if a read error occurs, the tape must be removed by pulling it through the channel and slot arrangement by hand. This is an experience known to fray tempers and calculated to wear patience to a thin ragged edge, especially with tapes several hundred feet in length. Punching tapes is a similarly nerve-wracking experience. The H10 pecks holes in paper tape at 10 characters per second, with the volume of a squadron of woodpeckers rat-tat-tatting on a tin roof. At $350.00 each, it is a safe bet that the microcomputer industry will never see another gadget competitive with the H10. It deserves a place in history alongside ENIAC.

KIT CONSTRUCTION

Persons with no electronics experience probably should not attempt to build equipment such as the H9, H10 or H11 without assistance. Kits are not all that difficult to assemble and can even be fun. However, the chances of making a mistake or installing a defective component increase with the complexity of the kit. Microcomputers are not particularly hard to repair as electronic systems go, but the difficulties can be fearsome to the neophyte.

The foregoing statements about kit building probably apply less to Heath Company products than to other makes of computer kits. Heath did not attain the position as the world's largest kit manufacturer by making their products difficult to assemble. Their step by step instructions are superbly written, and the manuals are well illustrated. Good documentation is essential for computer operation and for kit construction. Heath Company satisfies this requirement admirably.

Technical consultation and service are two more Heathkit strengths. The stickier problems of kit construction can usually be overcome by contacting the Heath technical consultants by phone or mail or by talking to the

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In any case, there are a few guidelines to follow when assembling a Heathkit. The first is to carefully inventory the kit before beginning construction. If any parts are missing, they can be replaced through the mail while the rest of the kit is being assembled. Second, follow the instructions. Component substitutions and changes can cause great confusion for those who rush haphazardly through the assembly procedure. Third, solder carefully. Those with no previous soldering experience should practice on something simple and inexpensive, such as a digital clock kit. It has been estimated that over 70% of all kit malfunctions are due to sloppy soldering.

The H11 switching power supply presents the greatest assembly challenge in the microcomputer kit, but it is not all that difficult. It consists of nine IC's and a considerable number of discrete parts, such as resistors and diodes. Very little can go wrong in the assembly process. The test procedure for this portion is quite detailed, and a DVM or VTVM is essential.

The cabinet, backplane/cardguide and switch board are extremely straightforward. The backplane (motherboard) entails considerable soldering, while the other sections require mostly work with a screwdriver and a nutdriver. Similarly, the memory, serial and parallel boards are relatively simple and can be assembled in one or two hours each. They involve a good deal of soldering, but there are no tricky operations. Heath uses rather inexpensive IC sockets; the leads on the IC's must be bent vertical and carefully inserted to insure good contact. If troubleshooting methods, test equipment and spare parts are up to it, the IC's could be soldered directly to the circuit boards which are of good quality. This would improve reliability but would make the boards very difficult to repair.

SOFTWARE

All H11 software is supplied on paper tape in executable machine code. No listings are supplied. Two high level languages are included in the package, BASIC and FOCAL-11, as well as a character oriented text editor, ED-11, and an assembler, PAL-11S. A library of programs which allow assembly/machine language programs to be linked, loaded, debugged and dumped is provided. A collection of device handlers, which are used to simplify assembly language I/O, completes the set.

The Heath/DEC version of BASIC is fairly typical of microcomputer implementations. Numerical quantities have 24 bits of precision which amounts to just less than six decimal digits. Three data types are supported, integer, real and exponential. Exponential, (floating point), representation is generally used for internal computations and storage, with I/O conversions as required. Strings of up to 255 characters can also be manipulated to some degree. Subscripted material and string variables are permitted with up to two subscripts per array.

Input/output can be accomplished with a terminal, reader/punch or a lineprinter, although the line length is limited to 72 characters and cannot be varied. By the way, the H36/LA36 DECwriter is not a lineprinter as claimed in the Heath manuals; it is a character printer/keyboard. Luckily BASIC does not know the difference and will treat the DECwriter as a lineprinter. Unfortunately, the same is not true of the PAL-11S assembler and its I/O package.

As far as the number and flexibility of the BASIC statements are concerned, this implementation is similar to many 8KB to 12KB versions available with other microcomputers. However, the H11 must be equipped with 8KW to run the DEC/Heath version.

Although the memory requirements are a little high, this is one of the fastest versions of BASIC available on a microcomputer. It is approximately four times faster than the 8KB Benton Harbor BASIC running on the Heath H8, depending on the application.

For a list of the statements, functions and commands available in H11 BASIC, refer to Figure 5. LEFT$, RIGHT$ and MID$ are implemented in the form of the SEG and STRING function. Notably lacking are the MIN, MAX and TAN arithmetic functions; the ON. . .GOSUB <list> and ON. . .GOTO <list> program control statements; and the BUILD, CONTINUE, VERIFY and STEP console commands.

```
COMMANDS                 STATEMENTS            PROGRAM CONTROL

SCRATCH                  DATA                  GOTO
OLD #n                   DEF                   GOSUB
LIST [line number]       DIM                   IF-THEN
SAVE #n                  INPUT <list>          IF-GOTO
RUN                      INPUT #n              FOR-NEXT
CLEAR                    LET                   RETURN
                         POKE                  END
                         PRINT #n              STOP
                         RANDOMIZE
                         READ <list>
                         REM
                         RESTORE

FUNCTIONS                STRING FUNCTIONS

ABS                      ASC
ATN                      CHR$
COS                      LEN
EXP                      POS
FRE                      SEG$
INT                      STR$
LOG                      VAL
PEEK
RND
SGN
SIN
SQR
TAB
FNa  (user defined)
```

Figure 5. A summary of H11 BASIC.

FOCAL-11 is a DEC originated language which derives its name from FOrmula CALculator. Two versions are supplied, one which runs in 4KW and a more sophisticated implementation which requires 8KW. FOCAL-11 is similar to BASIC in some respects. First, it is an interpreter rather than a compiler, and has about the same level of programmer interaction. Second, it is non-structured, requiring numbered program statements instead of the labeled blocks and routines of more advanced languages. Third, it is relatively simple to learn with a rather limited set of commands.

In other respects, BASIC and FOCAL-11 are quite different. Program storage is accomplished in straight ASCII text rather than in compact statement codes. Therefore, in order to save memory space, FOCAL-11 statements can be expressed with single letter codes. The way in which the statements are numbered gives FOCAL-11 program slightly more structure than a similar BASIC program.

Statement numbers range from 1.01 to 99.99. All statements with the same integer portion are said to belong to the same FOCAL GROUP. For instance, all statements between 7.01 and 7.99 belong to the same FOCAL GROUP. Such groups can be executed by use of a "DO" statement which is very similar to a GOSUB in BASIC. The statement "DO 7.1" would cause all statements in the sub-group from 7.10 to 7.19 to be executed, while "DO 7" would execute the group between 7.10 and 7.99.

Most of the other FOCAL-11 features are similar to BASIC commands and functions. However, some options are available which either place the programmer in closer contact with the hardware or allow some degree of real-time control over the software. For example, a function called FCLK returns the number of 60 Hz cycles which have elapsed since the H11 line time clock was enabled. Accurate interval timing is made possible by this feature. Other functions are implemented in the 8KW version which permit high level control of hardware interrupts, task scheduling, and recovery from execution errors such as overflow or divide by zero.

Text editing, another H11 feature, is used primarily for writing and correcting program statements and for preparing documents for printing. Heath provides this capability with the H11 in the form of a paper tape editor called ED-11. It can be used to prepare a program on a terminal, with the resulting source code punched on paper tape section by section.

Subsequently, the source program is read in by one of the language processors and either interrupted or assembled. After debugging, ED-11 can be used to change the program by reloading and re-editing the tape. Since BASIC and FOCAL-11 have limited editing commands included, ED-11 is usually reserved for assembly language programming.

Figure 6 lists the steps necessary to generate a working assembly language program with the H11 paper tape system. The ABS LDR, (Absolute Loader), is a kind of bootstrap routine which allows binary machine code programs such as the assembler or BASIC to be loaded into the H11. The ABS LDR itself is loaded by means of the μODT facilities. Each system program such as the editor or assembler must be loaded separately using the ABS LDR; it is not possible to have more than one resident in memory at the same time.

1. Load the ABS LDR.
2. Load the ED-11 text editor.
3. Write and punch an assembly language program.
4. Load the ABS LDR.
5. Load the PAL-11S assembler.
6. Read the program paper tape.
7. Second pass: read the program tape and punch the object tape.
8. Load the ABS LDR.
9. Load the LINK-11S linker.
10. Read the program object tape.
11. Read the IOXLP object tape.
12. Read the ODT object tape.
13. Second pass: read the program object tape and punch part of the load module.
14. Second pass: read the IOXLP object tape and punch part of the load module.
15. Second pass: read the ODT object tape and complete the load module.
16. Load the ABS LDR.
17. Load the program load module.
18. Run and debug the program, using IOXLP and ODT.
19. GOTO step 1 and repeat the procedure until the program works.

Figure 6. The steps in the assembly process.

The assembler is called PAL-11S for Program Assembly Language. It is a two-pass routine which is used to generate an assembled binary object module and a listing from assembly language source code. Several of these object modules are then processed by the LINK-11S linker to produce a final executable load module. The load module generally consists of a main routine, several subroutines and utilities such as the IOXLP input/output package or the machine language version of μODT, called ODT. These sections are organized and relocated by the linker so they may all reside simultaneously in memory as a single program. The main routine may call the subroutines or utilities to perform specific tasks such as control of the H10 reader/punch.

Since several passes through this entire procedure will normally be required to produce a fully debugged load module, it is obvious that the H10 is a tremendous handicap to the assembly language programmer.

SYSTEM SUPPORT

Since Heath Company has not announced plans for an H11 cassette system, the only viable option for those who need fast load/dump capabilities is to wait for the H27. Of course, DEC offers the RX01 dual floppy disk system, but it can take months to obtain one and the cost is about $6,000.00 including the RT-11 operating system. High level languages such as COBOL, APL and FORTRAN IV are also available from DEC, but they cost hundreds of dollars.

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We can supply the best software available on the market today to work with all of the computer systems we sell. Prices range from $100 to $1000 and include packages developed by Structured Systems Group, Compumax, Serendipity, and Grimes. Applications available include:

★General Ledger ★Accounts Receivable ★Accounts Payable ★ ★Inventory ★Payroll ★Order Entry ★Mail List ★ ★Word Processing ★

Sunshine Computer Company

20710 South Leapwood Ave.· Carson, California 90746 (213) 327-2118

At least a dozen other manufacturers produce LSI-11 compatible hardware and software products but their marketing strategies are generally not directed toward small end user applications such as home computers. Refer to Figure 7 for a partial list of the DEC LSI-11 accessories. It should be obvious that the LSI-11 is heavily supported, and can readily be used in small business, scientific and educational environments. However, it should also be apparent that most of the accessories available for the H11 are aimed at the commercial market. Heath Company is the only organization with an interest in the LSI-11 hobbyist market, and their offerings are rather limited when compared to the proliferation of S-100 bus options.

Circuit boards come in two sizes; dual connector units measure 8.5" X 5", while quad connector units measure 8.5" X 10". All boards are dual size unless noted otherwise.

PROCESSORS		
KD11-F	4KW onboard RAM (quad)	$990
KD11-HA	no memory (LSI-11/2™)	$450 (approximate)
KD11-J	4KW onboard CORE (two quad)	$1536
KD11-R	16KW onboard RAM (two quad)	$2490
MEMORIES		
MMV11-A	4KW CORE (quad)	$990
MRV11-AA	4KW PROM	$175 (without IC's)
MSV11-B	4KW RAM	$625
MSV11-DB	8KW RAM	$850
MSV11-DC	16KW RAM	$1375
MSV11-ED	32KW RAM (18 bits with parity)	$2525
INTERFACES		
DLV11	serial line unit	$250
DLV-J	four-port serial line unit	$465
DRV11	16-bit parallel line unit	$210
DRV11-B	DMA parallel unit	$580
DRV11-P	wire-wrap bus foundation	$275
AAV11-A	D/A converter (12 bits with four channels)	$900
ADV11-A	A/D converter (12 bits with 16 channels)	$1000
IBV11-A	IEEE-488 controller/talker/listener	$750
KWV11-A	programmable real-time clock	$600
PERIPHERALS		
RXV11-BA	dual floppy disks with controller	$4300
LS120	DECwriter III 180 CPS hardcopy terminal	$3990
LA180	DECprinter I 180 CPS lineprinter	$3240
VT52	DECscope video terminal (24 X 80 characters)	$2200

Figure 7. H11 compatible options from DEC.

The individual who purchases an H11 or other LSI-11 based system such as the PDP-11/03™ is provided with a set of basic tools which can be successfully utilized under the right circumstances. However, the only guarantees are those of product reliability. A computer must be programmed to perform a specific task, and this can represent a substantial investment in time and money. No computer company will assume responsibility for the fortunes, good or bad, of the end user.

A microcomputer system, especially one like the H11, can represent a substantial investment to a small businessperson or other ambitious and innovative individual. It can also represent a financial risk. When the technical ability and experience is small, the risks are correspondingly large. Some form of information exchange is essential. Clubs and private consultants are probably the best sources, but there are alternatives such as the Heath User's Group (HUG) and the Digital Equipment Corporation User's Society (DECUS™).

General information can be obtained from these organizations, and software can be exchanged for a nominal fee. However, assistance on a specific problem is usually too much to expect. Neither organization is in the software debugging and consulting business. The main function of HUG is to disseminate information about Heath computer products. New products and changes or improvements in old products are likely topics for the HUG Newsletter. DECUS has a somewhat

different function. The publications of this organization serve as a professional forum in computing techniques and theoretical developments. Only a small proportion of the information available through DECUS can be applied directly to the everyday problems of H11 users.

By now it should be obvious that the H11 does not offer the microcomputer enthusiast any great technological breakthroughs in hardware performance or software sophistication. There are a great many other 8-bit machines which can supply equal performance by means of S-100 bus options and well-designed software packages. Also, the H11 and other LSI-11 systems are generally more expensive than equivalent S-100 bus machines, perhaps because of the lack of competition from other 16-bit microcomputers.

However, the H11 has advantages which cannot be overlooked. One major advantage it offers is security to those individuals who are not technically inclined. The key is hardware and software systems support. Suppose a garage shop sells 600 memory boards for an S-100 bus computer. When the manufacturer goes broke due to low profit margins and bad management, who will repair the boards when they fail two years later? A die-hard home brew experimenter would probably relish the opportunity to repair his own boards. Unfortunately, the individual who can't distinguish a logic probe from a football bat would be in trouble.

Another consideration is that the age of the 16-bit microcomputer has arrived. Intel, Zilog and Motorola have announced new 16-bit microprocessors which should easily outperform the H11 and the common 8-bit machines by a factor of five or more. Since the S-100 bus was designed for 8-bit machines, specifically the 8080, it cannot be efficiently upgraded to 16-bit microprocessors.

Of course, 16-bit S-100 bus microcomputers are already available, including one based on the LSI-11 chip set, but they are kludges at best. Each 16-bit operation must be handled as two 8-bit operations, severely degrading the performance advantages offered by a 16-bit data path. The S-100 products will certainly not dry up and blow away; they have too much market inertia. However, the current 8-bit machines will become more and more difficult to support as the new 16-bit microcomputers take over.

Millions of dollars have been invested in the H11 and other LSI-11 products. They will be around for many years. The asynchronous 16-bit LSI-11 bus will also accommodate new 16-bit processors as technology improvements dictate. Present H11 memories and interface boards will be perfectly usable with the new high performance processors. As other manufacturers offer bus-compatible modules, the Heath and DEC prices will have to come down to remain competitive.

The S-100 bus became a de facto 8-bit microcomputer standard because it was first. Other manufacturers adopted it because of the market inertia which had been built up. In fact, this bus will slow the introduction of the 16-bit microcomputer more than any other single factor. Too much has been invested in the S-100 bus for it to be easily displaced. Unfortunately, it was not designed as a general-purpose bus, and new technological advances were not taken into consideration.

If a standard 16-bit microcomputer bus is to be adopted, it should be done as soon as possible. Since the LSI-11 was the first 16-bit microcomputer, perhaps its bus will become the hobbyist standard of the near future. On the other hand, there are probably better alternatives, such as Intel's Multibus™. In any case, the H11 is gaining some popularity among hobbyists and home computer enthusiasts. Heath Company and the Digital Equipment Corporation are leading the way into the 1980's — the decade of the 16-bit microcomputer. □

NEW PRODUCTS

MICROCOMPUTERS

MITS 300

The MITS 300 is a microcomputer-based integrated business system. Available in two configurations, a hard-disk system and a floppy disk system, the MITS 300 is a complete hardware and software system.

The MITS 300 provides capabilities for word processing, inventory control and accounting functions including general ledger, accounts payable, accounts receivable, and payroll.

The MITS 300 hard-disk system (MITS 300/55) is priced at $15,950 and the floppy disk system (MITS 300/25) is priced from $11,450. The A08 accounting software package is available for $4,000. For more information contact Pertec Computer Corp., Microsystems Div., 21111 Erwin St., Woodland Hills, CA 91367, (213) 999-2020, Neil McElwee.

CIRCLE INQUIRY NO. 121

The C3-B

The C3-B is a fully packaged Winchester disk based microcomputer system in a 42" equipment rack. The system includes in its minimal configuration, 48K of static RAM, Ohio Scientific's triple processor CPU board which has 6502A, 6800 and Z-80 microprocessors, dual floppy disk drives for program and data mobility, and a 74 million byte Winchester technology fixed disk.

The C3-B system comes complete with OS-65U disk operating system with extended BASIC. This operating system features virtual data files and directly supports high performance file structures such as multi-key ISAM.

Single unit price for the C3-B is $11,090. OEM quantity discounts are available. For more information contact Ohio Scientific, 1333 S. Chillicothe Rd., Aurora, OH 44202, (216) 562-3101.

CIRCLE INQUIRY NO. 122

PERIPHERALS

Centronics Introduces High Performance 1200 BPS Teleprinter

The Model 765 is a teleprinter in the higher asynchronous transmission speed range and is available in eight standard configurations.

Capable of sustaining 1200 baud at a minimum of 200 cps, the microprocessor-controlled Model 765 offers a wide variety of features appealing to users of public switch or private communications networks and those who simply wish to increase their throughput in direct connect applications.

High throughput, operational flexibility, print quality, reliability and competitive pricing all make the Model 765 the best price/performance teleprinter available.

The three optional features available for the eight standard configurations include expanded buffering (2K to produce a 3K maximum), quietized cabinet and answer-back capability.

Prices range from $2,975 for the 765-1 KSR standard unit to $2,980 for the 765-8 RO standard unit with alternate character set. For more information contact Centronics Data Computer Corp., Hudson, NH 03051, (603) 883-0111, Chuck Clemente.

CIRCLE INQUIRY NO. 123

CalComp Drum Plotter

The Model 1012 Drum Plotter is a low-cost, high-speed, microprocessor-based plotter specifically designed for remote or timesharing applications.

The desk-top unit can operate at speeds up to 10 inches per second (ips), with a resolution of .05mm. The plotter has four pens and uses Z-fold paper 11 inches wide.

The Model 1012 comes with an integral RS-232-C controller so that the unit also can connect directly to hose computers and can support a variety of CRT terminals. A 256 byte input buffer is standard, along with switch-selectable baud rates from 110 to 9600 baud.

The price is $6,500 in single quantities. Delivery is scheduled for January 1979. For more information contact California Computer Products, Inc., 2411 W. La Palma Ave., Anaheim, CA 92801, (714) 821-2541, Carol Felton.

CIRCLE INQUIRY NO. 124

DISKS

FD200 Microfloppy Disk Drive

The FD250 is a double-head version of the double-density FD200 Microfloppy disk drive. The FD250 stores up to 437,500 bytes without operator intervention. Double-density, hard or soft sectoring, and write protect are all standard features. The unit can write and read data on both sides of a diskette.

Seek time for the FD250 is 25 msec. track-to-track, with head settling time of 10 msec. (last track addressed) and head loading time of 35 msec. (maximum).

For more information contact PCC, Pertec Div., 9600 Irondale, Chatsworth, CA 91311, (213) 822-9222, Neil McElwee.

CIRCLE INQUIRY NO. 125

Double-Headed Flexible Disk Drive

The FD650 is a standard-sized (8-inch), double-headed flexible disk drive capable of recording and reading data on both sides of an IBM (or equivalent) Diskette 2 or 2D. The new drive also features double density recording to offer an immediately addressable unformatted storage capacity of 1.6 megabytes.

The drive is housed in a die-cast aluminum base with a molded plastic bezel and electrically locked door.

The FD650 is priced at $755 in single quantities. OEM quantity discounts are available. For more information contact PCC, Pertec Div., 9600 Irondale Ave., Chatsworth, CA 91311, (213) 822-9222, Neil McElwee.

CIRCLE INQUIRY NO. 126

TERMINALS

DASI 744 Terminal

The new DASI 744 terminal is a modified Texas Instruments 743 enhanced with switch selectable parity, EIA RS 232 interface and cable, answer mode and acoustic coupler.

Its additional features offer greater user flexibility and versatility. The switch selectable parity enables users to communicate with any number of time-sharing devices. The EIA RS232 interface and cable allows direct hook-up to minicomputers as well as remote access through the acoustic coupler.

Price of the new terminal is $1595. For more information contact Data Access Systems, 100 Route 46, Mountain Lakes, NJ 07046.

CIRCLE INQUIRY NO. 127

Graphics Display Terminal

The Princeton 8500M is a user programmable, intelligent, microprocessor based computer graphic terminal capable of operating as a free standing computer graphic system.

The unit includes provision for numerous add-ons such as floppy disk and DOS (compatible with Motorola software) and contains a combination of other unique capabilities and features such as expandable RAM, for storing user designed characters and symbols; repeat/parameter update, allowing data compression; sophisticated graphic generation capability including conic section, shaded and textured vectors, windowing and scaling.

For more information contact Princeton Electronic Products, Inc., Dept. H, P.O. Box 101, North Brunswick, NJ 08920, (201) 297-4448.

CIRCLE INQUIRY NO. 128

I/O CARDS

32-Channel Analog Data Acquisition System

A versatile Data Acquisition System designed to interface analog signals with the Control Logic MM1 microcomuter provides 32 analog input channels. The MM1-AI/AO module plugs directly into a slot in the MM1 microcomputer Polybuss and is pin-for-pin compatible with the MM1 system.

A Real-Time Pacer Clock system included in the MM1-AI/AO provides for synchronization of data acquisition with real-world time and also can be used to trigger A/D conversions at precisely timed intervals. Specific frequency of the crystal-controlled clock is determined by the user. Maximum throughput rate is 28 KHz.

Other features of the new Data Acquisition System include auxiliary I/O interface, sample and hold amplifier and an optional on-board power supply.

Accuracy of resolution with the MM1-AI/AO is 12 bits with non-linearity error of ½ least significant bit typical and over-all error of ± 1 LSB.

Also offered is a separate Analog Input only and Analog Output only modules in the same 7" x 10" PC card format, both of which are plug-in compatible with the MM1 microcomputer.

Price of the MM1-AI/AO is $1,050. Delivery is 30 days ARO. For more information contact Control Logic, Inc., Nine Tech Cir., Natick, MA 01760, (617) 655-1170.

CIRCLE INQUIRY NO. 129

Broder Logic Trainer™

Trains students without previous electronic background for digital electronic related assignments. Improves and grades the ability of technicians, designers, engineers, technical writers, buyers, etc.

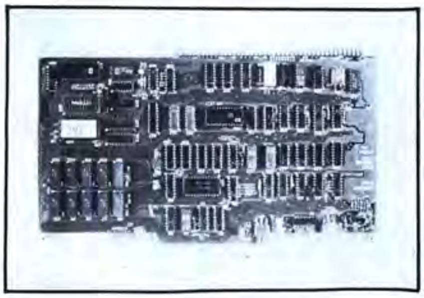
Physical logic state manipulation and the visual display make for fast and retained learning. Extremely practical problems are related to computers, communications, etc.

A manual, 40 digital problems, and a 9V battery are included. Requires no wire or IC manipulation. Price is $69.95 each. For more information contact L.J. Broder Enterprises Inc., 3192 Darvany Dr., Dallas, TX 75220, (214) 357-7763, Audrey Broder.

CIRCLE INQUIRY NO. 130

Easily Customized Video Terminal Board

The VideoTerm is an Intel Multibus™ and NSC compatible video terminal board with microprogrammed control codes.



The Model VT-103A provides I/O controlled raster-scan display for Intel SBC/NSC BLC computers. It generates a 96 character ASCII subset in 7x9 font, with any combination of normal, reverse video and blink. Custom fonts can be developed via bipolar PROM. Direct cursor positioning, 11 other cursor functions and read back of cursor position and screen data are under board control.

The board has an 8-bit keyboard port which can operate in a polled or interrupt mode. Composite and direct drive video outputs are provided.

The VideoTerm is priced from $495; quantity discounts are offered. For more information contact Datacube SMK Inc., 670 Main St., Reading, MA 01867, (617) 944-4600, J. Stewart Dunn, Marketing

CIRCLE INQUIRY NO. 144

Single Board Magnetic Tape Controller

The Dilog I Magnetic Tape Controller couples up to eight 7- or 9-track magnetic tape drives to LSI-11 based computer systems. The controller is completely contained on one quad module that occpies two device locations in an LSI-11 quad backplane.

The single board design incorporates a microprocessor to reduce component count. The microprocessor makes possible on-board automatic self-test diagnostics that permit malfunctions to be visually isolated to the computer, the controller or the tape drives.

Quantity one price is $2,295. Delivery is 30 days. For more information contact Distributed Logic Corp., 12800 "G" Garden Grove Blvd., Garden Grove, CA 92643, (714) 534-8950.

CIRCLE INQUIRY NO. 145

MEMORY CARDS

Memory Upgrades for Wang 2200

A new memory upgrade service is being offered for owners of the Wang 2200 A, B, C, T or S processors.

A, T or S memory board which now supports 8K bytes of RAM can be upgraded to 16 kilobytes. The original Wang board is used.

An A, B or C memory board which now supports 4K bytes of RAM can be upgraded to 8 kilobytes. The original Wang board is used.

Rarity of parts to upgrade A, B, or C memory makes its pricing higher than that of T or S board. Prices are $495 for T, S upgrade and $595 for A, B, C upgrade. For more information contact Digimates, Inc., Box 593, Littleton, CO 80120, (303) 733-1377, Gus Galabrese.

CIRCLE INQUIRY NO. 131

PET Memory

Up to 20K bytes of storage are provided on one low cost add on memory card for Commodore's PET microcomputer.

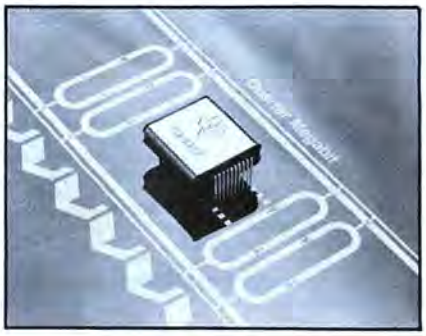
Adaptor hardware allows use of PET's internal power supply or user supplied external supply. User has option to install memory card either inside PET or externally in user supplied cabinetry.

4K static memory technology is used, guaranteeing card will work at the PET 2000's full rated speed. Single quantity price is $695. For more information contact Digimates, Inc., Box 593, Littleton, CO 80120, (303) 733-1377.

CIRCLE INQUIRY NO. 132

Magnetic Bubble Memory Product Family from TI

The TIB303 is a quarter-million-bit magnetic bubble memory featuring block replicate. Operating temperature range is 0-50°C. Price is $500.



The TIB0203 is a 92K bit magnetic bubble memory with chevron propagating element design. Price is $125.

The BKA0203A is an assembled and tested printed circuit board subassembly complete with TIB0203 magnetic bubble memory. Price is $250.

TMS5502/9916 is a MOS controller IC that provides an interface between a TMS9900 or TMS8080 microprocessor and the bubble memory. Price is $50.

The BCA0200A is an assembled and tested printed circuit board subassembly complete with TMS5502/9916 MOS controller and mating microprocessor connector/cable assembly. Price is $250.

For more information contact Texas Instruments Inc., P.O. Box 5012, Dallas, TX 75222, (214) 238-2481, Dan Garza or Reed Trask.

CIRCLE INQUIRY NO. 133

P.O. Box 4430N Santa Clara, CA 95054
For will call only: (408) 988-1640
2322 Walsh Ave.

Quest ELECTRONICS

Same day shipment. First line parts only. Factory tested. Guaranteed money back. Quality IC's and other components at factory prices.

QUEST Cosmac Super Elf Computer $106.95

Compare features before you decide to buy any other computer. There is no other computer on the market today that has all the desirable benefits of the **Super Elf** for so little money. The Super Elf is a small single board computer that does many **big** things. It is an excellent computer for training and for learning programming with its machine language and yet it is easily **expanded** with **additional memory, Tiny Basic, Ascii Keyboards, video character generation, etc.**

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are shown on several LED indicator lamps.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, input, memory protect, memory select, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector for PC cards and a 50 pin connector for the **Quest Super Expansion Board**. Power supply and sockets for **all** IC's are included in the price plus a detailed 90 page instruction manual.

Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and research and development.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Hardwood Cabinet** with drilled and labelled front panel **$24.95. NiCad Battery Backup Kit $4.95.** All kits and options also come completely assembled and tested.

Questdata, a 12 page monthly software publication for 1802 computer users is available by subscription for $12.00 per year.

Tiny Basic for ANY 1802 System

Cassette $10.00. On ROM Monitor $38.00. Super Elf owners, 30% off. **Object code listing or paper tape with manual $5.50. Original ELF Kit Board $14.95.**

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow you to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface.** Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf.** The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed** ($12.00 value). EPROM can be used for the monitor and Tiny Basic or other purposes.

A IK Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, video graphics driver with blinking cursor and block move capability. The Super Monitor is written with subroutines allowing users to take advantage of monitor functions simply by calling them up. Improvements and revisions are easily done with the monitor. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake.** They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. A Godbout 8K RAM board is available for $127.95. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50. A 50 pin connector set** with ribbon cable is available at $12.50 for easy connection between the **Super Elf** and the **Super Expansion Board.**

The **Power Supply** for the Super Expansion Board is a 5 amp supply with + 8v ± 18v + 12v − 5v. Regulated voltages are +5v & +12v $29.95. Deluxe version includes the case at $39.95.

INTEGRATED CIRCUITS

7400TTL	
7400N	.17
7402N	.17
7404N	.19
7409N	.23
7410N	.17
7414N	.63
7420N	.17
7422N	1.39
7430N	.20
7442N	.50
7445N	.69
7447N	.60
7448N	.69
7450N	.17
7474N	.29
7475N	.49
7485N	.88
7489N	2.00
7490N	.43
7492N	.43
7493N	.43
7495N	.69
74100N	.90
74107N	.29
74121N	.34
74123N	.59
74125N	.39
74145N	.69
74150N	.95
74151N	.69
74154N	1.00
74157N	.69
74161N	.87
74162N	.87
74163N	.87
74174N	.96
74175N	.90
74190N	1.15
74192N	.87
74193N	.85
74221N	1.55
74298N	1.65
74365N	.66
74366N	.66
74367N	.66

74LS00 TTL	
74LS00N	.25
74LS02N	.25
74LS04N	.25
74LS05N	.25
74LS08N	.25
74LS10N	.25
74LS13N	.40
74LS14N	.90
74LS20N	.25
74LS22N	.25
74LS28N	.41
74LS30N	.25
74LS33N	.39
74LS38N	.30
74LS74N	.35
74LS75N	.47
74LS90N	.51
74LS93N	.51
74LS95N	1.89
74LS107N	.35
74LS112N	.35
74LS113N	.35
74LS132N	.72
74LS136N	.35
74LS151N	.67
74LS155N	.67
74LS157N	.67
74LS162N	.91
74LS163N	.91
74LS174N	.95
74LS190N	1.06
74LS221N	1.95
74LS258N	.67
74LS367N	.89

LINEAR	
CA3045	.90
CA3046	.67
CA3081	1.80
CA3082	1.90
CA3089	2.95
LM301AN/AH	.35
LM305H	.87
LM307N	.35
LM308N	.89
LM309H	1.15
LM309K	.95
LM311H/N	.90
LM317T/K	2.92
LM318	1.35
LM320K-5	1.20
LM323K-5	6.95
LM320K-12	1.35
LM320K-15	1.35
LM320T-5	1.60
LM320T-8	1.60
LM320T-12	1.50
LM320T-15	1.60
LM324N	1.15
LM339N	1.55
LM340K-5	1.10
LM340K-8	1.10
LM340K-12	1.10
LM340K-15	1.10
LM340K-24	1.10
LM340T-5	1.10
LM340T-8	1.10
LM340T-12	1.10
LM340T-15	1.10
LM340T-18	1.10
LM340T-24	1.10
LM343H	4.50
LM370	1.15
LM377	4.50
LM379	5.00
LM380N	1.00
LM381	1.60
LM382	1.60
LM703H	.40
LM709H	.28
LM723H/N	.50
LM733N	.67
LM741CH	.35
LM741N	.25
LM747H/N	.62
LM748N	.35
LM1303N	.82
LM1304	1.10
LM1305	1.27
LM1307	2.00
LM1310	2.75
LM1458	.47
LM1800	1.75
LM1812	7.50
LM1889	3.00
LM2111	1.75
LM2902	1.50
LM3900N	.60
LM3905	1.75
LM3909N	.61
MC1458V	.50
NE540L	2.89
NE550N	.65
NE555V	.43
NE556A	.79
NE565A	1.00
NE566V	1.50
NE567V	1.20
NE570B	5.00
NE571B	5.00
78L05	.60
78L08	.60
79L05	.70
78M05	.85
75108	1.75
75491CN	.50
75492CN	.55
75494CN	.89

A to D CONVERTER	
8038B	4.50
8700CJ	13.95
8701CN	22.00
8750CJ	13.95
LD130	9.95
9400CJV/F	7.40
ICL7103	9.50
ICL7107	14.25

CMOS	
CD34001 Fair.	.50
CD4000	.16
CD4001	.21
CD4002	.21
CD4006	1.10
CD4007	.21
CD4008	.21
CD4009	.39
CD4010	.39
CD4011	.21
CD4012	.21
CD4013	.36
CD4014	.86
CD4015	.86
CD4016	.36
CD4017	.94
CD4018	.94
CD4019	.21
CD4020	1.02
CD4021	1.02
CD4022	.86
CD4023	.21
CD4024	.75
CD4025	.21
CD4026	1.51
CD4027	.36
CD4028	.79
CD4029	1.02
CD4030	.21
CD4035	1.02
CD4040	1.02
CD4042	.71
CD4043	.63
CD4044	.63
CD4046	1.67
CD4049	.36
CD4050	.36
CD4051	1.13
CD4060	1.42
CD4066	.71
CD4068	.40
CD4069	.40
CD4070	.40
CD4071	.21
CD4072	.21
CD4073	.21
CD4075	.21
CD4076	1.75
CD4078	.40
CD4081	.21
CD4082	.21
CD4116	.47
CD4490	5.50
CD4507	1.00
CD4508	4.25
CD4510	1.02
CD4511	.94
CD4515	2.52
CD4516	1.10
CD4518	1.02
CD4520	1.02
CD4527	1.51
CD4528	.79
CD4553	5.75
CD4566	2.25
CD4583	4.50
CD4585	1.10
CD40192	3.00
74C00	.28
74C04	.33
74C10	.28
74C14	2.10
74C20	.28
74C30	.28
74C48	1.95
74C74	.75
74C76	1.40
74C90	1.15
74C93	1.40
74C154	3.00
74C160	1.44
74C175	1.35
74C192	1.65
74C221	2.00
74C905	3.00
74C906	.75
74C914	1.95
74C922	5.50
74C923	5.50
74C925	6.95
74C926	6.95
74C927	6.95

INTERFACE	
8095	.65
8096	.65
8097	.65
8098	.65
8T09	1.25
8T10	4.50
8T13	3.00
8T20	5.50
8T23	3.10
8T24	3.50
8T25	3.20
8T26	1.69
8T28	2.75
8T97	1.69
8T98	1.69

MOS/MEMORY RAM	
2101-1	3.95
2102-1	.95
2102AL-4	1.60
21F02	1.25
2104A-4	4.95
2107B	4.95
2111-1	3.75
2112-2	3.95
2114	8.50
4116	17.95
2513B	6.30
21L02-1	1.49
MM5262	.40
MM5280	3.00
MM5320	9.95
MM5330	5.94
PD411D-3	4.00
PD411D-4	5.00
P5101L	13.95
4200A	9.95
82S25	2.90
91L02A	1.75
HD0165-5	6.95
MM57100	4.50
GIAY38500-1	9.95
MCM6571A	9.95
9368	3.50
4100	10.00
416	16.00

CLOCKS	
MM5309	3.00
MM5311	3.60
MM5312	4.80
MM5313	3.60
MM5314	3.90
MM5315	4.00
MM5316	5.00
MM5318	3.60
MM5369	2.10
MM5841	14.45
MM5865	7.95
CT7001	5.80
CT7002	8.95
CT7010	8.95
CT7015	7.25
MM5375AA/N	3.90
MM5375AB/N	4.90
7205	16.50
7207	7.50
7208	15.95
7209	4.95
DS0026CN	3.75
DS0056CN	3.75
MM53104	2.50

MICROPROCESSOR	
6800	17.50
6802	24.95
8080A with data	8.95
8085	27.00
Z80	29.95
8212	2.90
8214	8.00
8216	2.90
8224	2.90
8228	5.35
8251	8.50
8253	10.00
8255	9.25
8257	19.50
8259	19.50
CDP1802CD	19.95
CDP1802D	25.00
CDP1861	12.95
6820	9.95
6850	12.95
6502	12.50

IC SOCKETS

Solder Tin Low Profile			
PIN	1 UP	PIN	1UP
8	.15	22	.30
14	.18	24	.35
16	.20	28	.42
18	.27	36	.58
20	.29	40	.57

3 level wire wrap gold.
14 pin .25 16 pin .27
2 level 14 pin ww .20

WIRE WRAP LEVEL 3

PIN		PIN	
14	.25	24	.86
16	.27	28	1.00
18	.57	40	1.23

UART/FIFO	
AY5-1013	5.50
AY5-1014	7.50
3341	6.95

PROM	
1702A	3.95
N82S23	2.95
N82S123	3.50
N82S126	3.75
N82S129	3.75
N82S131	3.75
N82S136	8.75
N82S137	8.75
2708	12.50
DM8577	2.90
8223	2.90
2716T1	22.50
2716 Intel	48.00

CRYSTALS	
1 MHz	4.50
2 MHz	4.50
4 MHz	4.25
5 MHz	4.25
10 MHz	4.25
18 MHz	3.90
20 MHz	3.90
32 MHz	3.90
32768 MHz	4.00
1.8432 MHz	4.50
3.5795 MHz	1.20
2.0100 MHz	1.95
2.097152 MHz	4.50
2.4576 MHz	4.50
3.2768 MHz	4.50
5.0688 MHz	4.50
5.185 MHz	4.50
5.7143 MHz	4.50
6.5536 MHz	4.50
14.31818 MHz	4.25
18.432 MHz	4.50
22.1184 MHz	4.50

CONNECTORS	
44 pin edge	2.00
100 pin edge	4.50
100 pin edge WW	4.50

KEYBOARD ENCODERS	
AY5-2376	$12.50
AY5-3600	13.50
74C922	5.50
74C923	5.50
HD0165-5	8.95

IC Test Clips	1	10
Red	.55	.47
Black	.55	.47

Keyer 8043 14.50
comp. w/spec./sock.

TRANSISTORS	
2N1893	.40
2N2222A	.18
2N2369	.30
2N2904A	.20
2N2907A	.25
2N3053	.40
2N3638	.25
2N3643	.25
2N3904	.18
2N3906	.18
2N3055	.69
2N4400	.25
2N4401	.75
2N4402	.20
TIP31	.60
TIP33A	1.00

CLOCK MODULES Complete alarm clocks ready to hook up with transformer and switches. Very compact with .50" and .84" digits.

MA1002A, C or E .50"	8.95
102P3 Transformer	2.25
MA1010A, C or E .84"	11.95
102P2 Transformer	2.25
Special transformer and six switches when purchased w/module	2.95
MA1003 car module .3" green fluor. display	15.95

RESISTORS ¼ watt 5%
10 per type .03 1000 per type .012
25 per type .025 350 piece pack
100 per type .015 5 per type 6.75

KEYBOARDS

56 key ASCII keyboard kit	$62.50
Fully assembled	72.50
53 key ASCII keyboard kit	55.00
Fully assembled 65.00 Enclosure	14.95

LEDS

Red TO18	.15
Green, Orange, Yellow TO18	.20
Jumbo Red	.20
Green, Orange, Yellow Jumbo	.25
Clipilte LED Mounting Clips	8/$1.25

(specify red, amber, green, yellow, clear)

CONTINENTAL SPECIALTIES in stock Complete line of breadboard test equip. **MAX-100 8 digit Freq. Ctr. $128.95**

OK WIRE WRAP TOOLS in stock
Portable Multimeter $18.00

DIGITAL THERMOMETER $48.50 Batt. oper. General purpose or medical 32°-230°F. Disposable probe cover ±.2° accuracy. Comp. Assy. in compact case.

COMPUTER BOARD KITS

8K RAM Board Kit	$134.95
4K EPROM Kit	114.95
I/O Board Kit	44.50
Extender Board w/connector	12.50
Video Interface board kit	125.00
16K EPROM board kit w/o PROMS	74.50
16K Static RAM board kit	395.00
North Star Floppy Disk Kit	$665.00
Additional Drive Kit	415.00

SPECIAL PRODUCTS

MM5865 Stopwatch Timer	9.00
PC board	7.50
Switches Mom. Pushbutton	.27
3 pos. slide	.25
Encoder HD0165-5	6.95
3 Digit Universal Counter Board Kit Operates 5-18 Volt DC to 5 MHz typ. .125" LED display	10.50
Voice actuated switch	.50
Paratronics 100A Logic Analyzer Kit	$224.00
Model 10 Trigger Expander Kit	$229.00
Model 150 Bus Grabber Kit	$369.00

TRANSFORMERS

6V 300 ma	3.25
12 Volt 300 ma transformer	1.25
12.6V CT 600 ma	3.75
12V 250 ma wall plug	2.95
12V CT 250 ma wall plug	3.50
24V CT 400 ma	3.95
10V 1.2 amp wall plug	4.85
18V 6 amp	12.95

DISPLAY LEDS

MAN1	CA	.270	2.90
MAN3	CC	.125	.39
MAN72/74	CA/CA	.300	1.00
DL704	CC	.300	1.25
DL707/DL707R	CA	.300	1.00
DL727/728	CA/CC	.500	1.90
DL747/750	CA/CC	.600	1.95
DL750	CC	.600	1.95
FND359	CC	.357	.70
FND500/507	CC/CA	.500	1.35
FND503/510	CC/CA	.500	.90
FND800/807	CC/CA	.800	2.20
3 digit Bubble			.60
4 digit bubble			.80
DG8 Fluorescent			1.75
DG10 Fluorescent			1.75
5 digit 14 pin display			1.00
NSN69 9 digit display			.60
7520 Clairex photocells			.39
TIL311 Hex			9.50

COMPUTER GRADE CAPS

1600	mfd	200V	4.50
2000	mfd	45V	2.50
3200		50V	2.50
5500		25V	2.50
5800		40V	3.00
6100		40V	3.00
6100		50V	3.00
7700		50V	2.50
8000		55V	2.50
9400		65V	3.00
10000		20V	2.50
12000		30V	3.50
35000		25V	5.00
55000		25V	5.00
82000		15V	6.00
160000		10V	6.00

Auto Clock Kit $15.95

DC clock with 4-.50" displays. Uses National MA-1012 module with alarm option. Includes light dimmer, crystal timebase PC boards. Fully regulated, comp. instructs. Add $3.95 for beautiful dark gray case. Best value anywhere.

RCA Cosmac VIP Kit 229.00

Video computer with games and graphics.

Not a Cheap Clock Kit $14.95

Includes everything except case. 2-PC boards. 6-.50" LED Displays. 5314 clock chip, transformer, all components and full instrucs. Green and orange displays also avail. **Same kit w/.80" displays.** Red only. **$21.95**

60 Hz Crystal Time Base Kit $4.40

Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy. Kit includes: PC board, MM5369, crystal, resistors, capacitors and trimmer.

Digital Temperature Meter Kit

Indoor and outdoor. Switches back and forth. Beautiful. 50" LED readouts. Nothing like it available. Needs no additional parts for complete, full operation. Will measure −100° to +200°F, tenths of a degree, air or liquid. Very accurate. **$39.95**
Beautiful hardwood case w/bezel **$11.75**

NiCad Battery Fixer/Charger Kit

Opens shorted cells that won't hold a charge and then charges them up, all in one kit w/full parts and instructions. **$7.25**

PROM Eraser

Ultraviolet, assembled **$49.95**

Clock Calendar Kit $23.95

CT7015 direct drive chip displays date and time on .6" LEDS with AM-PM indicator. Alarm/doze feature includes buzzer. Complete with all parts, power supply and instructions, less case.

Sinclair 3½ Digit Multimeter

Batt./AC oper. 1mV and .1NA resolution. Resistance to 20 meg. 1% accuracy. Small, portable, completely assem. in case. 1 yr. guarantee. Best value ever! **$59.95**

Video Modulator Kit $8.95

Convert your TV set into a high quality monitor without affecting normal usage. Complete kit with full instructions.

2.5 MHz Frequency Counter Kit

Complete kit less case **$37.50**

30 MHz Frequency Counter Kit

Complete kit less case **$47.75**
Prescaler kit to 350 MHz **$19.95**

1978 IC Update Master Manual

1978 IC Update Master Manual **$24.50.** Complete IC data selector, 2175 pg. Master reference guide. Over 42,000 cross references. Free update service through 1978. Domestic postage $3.50. Foreign $6.00.

Stopwatch Kit $26.95

Full six digit battery operated. 2–5 volts. 3.2768 MHz crystal accuracy. Times to 59 min., 59 sec., 99 1/100 sec. Times std., split and Taylor. 7205 chip, all components minus case. Full instructions.

D Connectors RS232

25 Pin Subminiatures

DB25P	2.95	DE9P	1.50
DB25S	3.95	DE9S	1.95
Cover	1.50	DA15P	2.10
RS232 Complete Set	6.50	DA15S	3.10

S-100 Computer Boards

8K Static RAM Kit	$127.00
16K Static RAM Kit	265.00
24K Static RAM Kit	423.00
32K Dynamic RAM Kit	449.00
64K Dynamic RAM Kit	945.00
8K/16K Eprom Kit (less PROMS)	**$89.00**
Video Interface Kit	**$139.00**
Motherboard **$39.** Extender Board	**$8.99**

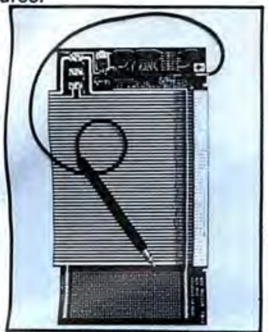
**TERMS: $5.00 min. order U.S. Funds. Calif residents add 6% tax.
BankAmericard and Master Charge accepted.
Shipping charges will be added on charge cards.**

FREE: Send for your copy of our NEW 1978 QUEST CATALOG. Include 28¢ stamp.

TEST EQUIPMENT

Second Generation S-100 Bus Extender Board Kit

The Mullen TB-2 Extender Board Kit retains the price of its predecessor, but offers several new features.



The built-in logic probe now reads into a 7-segment display, and also includes a pulse catcher plus an LED whose brightness corresponds to the duty cycle of a pulse stream.

The TB-2 also incorporates features of the previous model: links in the power supply lines for current measurement/fusing/independent supply switching; an edge connector label that identifies power, ground, and S-100 bus signal pins; full width board size to allow use of card guides; and gold plated edge connector teeth that stand up to repeated insertions.

The board lists for $35. For more information contact Mullen Computer Products, P.O. Box 6214, Hayward, CA 94545, (415) 783-2866, Bob Mullen.

CIRCLE INQUIRY NO. 134

New Programmable Pulse Generators

Models 1505 and 1506 are two programmable pulse generators with enhanced output capabilities. Designed for automatic test system applications requiring subnanosecond risetime, the 1505 and 1506 feature subnanosecond ECL Pulse Drivers (500pS) and 3nS timing.

Based on the proven output design of the EH 1503, the single-channel 1505 and the dual channel 1506 can drive the fastest digital logic circuits. Each model can be easily integrated into an automatic test system through external triggering, gate inputs and three trigger outputs.

Price for the 1505 is $5595. The 1506 is at $8150. Delivery within 90 days. For more information contact EH International, Inc., 515 11th St., P.O. Box 1289, Oakland, CA 94604, (415) 834-3030.

CIRCLE INQUIRY NO. 135

POWER SUPPLIES

Sola's New Micro/Minicomputer Regulators

The expanded Sola line features two new 60 Hz models with 140 and 250 VA load ratings to accommodate low-power devices such as CRT terminals, point-of-sale systems, word processing equipment and energy management instrumentation.

Designed to reject two types of noise considered most disturbing to electronic equipment, the regulators provide transverse-mode noise attenuation of 60 dB in addition to common-mode noise attenuation of 120 dB.

For more information contact Sola Electric, 1717 Busse Rd., Elk Grove Village, IL 60007, (312) 439-2800.

CIRCLE INQUIRY NO. 136

COMPONENTS

Plugs and Sockets for Carrying High Voltages

Highvol connectors conduct voltages of up to 20 KV DC in confined spaces, while having no adverse affect on adjacent components.

The standard range comprises 12 types of connector — 9 female and 3 male — all of which can be supplied as single connectors or made up as double-ended connectors in any combination.

Each Highvol connector can be supplied in one of three grades of Polyethylene — low density, high density or flame retardant — and comes complete with integral cable of up to 10 amp capacity.

For more information contact Highvol Connectors Ltd through their U.S. agent, English Sales Associates, 23011 Moulton Pkwy, Suite D-5, Laguna Hills, CA 92653, (714) 770-2727.

CIRCLE INQUIRY NO. 137

Stand-Off LED Display Socket for Plug-In Applications

The Model 1802-14-CN-B is a new standard Stand-Off LED Display Socket available from Garry Manufacturing. The new product is a molded 14-position Dual-in-Line (DIP) socket that provides a 0.830-inch stand-off when dip-soldered to a printed circuit board.

Contacts of the socket are precision screw machine brass parts gold-plated over nickel with four-tine, beryllium spring clips, gold over nickel-plated. The stand-off body insulator is molded of Valox SE-O grade, flame-retardant polyester.

Prices range $4.00 to $1.25, depending on quantity. Delivery is 2-4 weeks. For more information contact Garry Manufacturing Co., 1010 Jersey Ave., New Brunswick, NJ 08902, (201) 545-2424, Harry A. Koppel.

CIRCLE INQUIRY NO. 138

16-Channel, 12-Bit Integrated Circuit

The AD363 is a complete, 16-channel, 12-bit integrated circuit data acquisition system which allows users to mix single-ended and differential signals and select either without hard wiring.

The device is packaged in two hermetic 32-pin metal DIPs and offers true 12-bit accuracy, guaranteed no missing codes over temperature and 30 kHz throughput rate.

The two hermetic packages include two 8-channel multiplexers, a differential amplifier, a sample-and-hold circuit, a latched channel address register, an input mode control, control logic and a 12-bit A/D converter, which includes a fast buffer amplifier for external application and a precision reference for external application.

Price is $139.50 in 100's. For more information contact Analog Devices Semiconductor, 829 Woburn St., Wilmington, MA 01887, (617) 935-5565, Doug Grant.

CIRCLE INQUIRY NO. 146

120-Pin P.C. Connector Offers Low Insertion/Withdrawal Force

The Hypertac® KA 120 contact P.C. connector features a patented contact design that makes a reliable electrical connection while requiring only a 7.5 lb. insertion/withdrawal force.

In addition to standard rear removable contacts, this connector offers front removal contacts that can easily be replaced without removal of the connector itself in mother board applications. Keyed guide pins insure precise alignment during insertion.

The Hypertac is priced from approximately $.50 per mated line. For more information contact Hypertronics Corp., 2352 Main St., Concord, MA 01742, (617) 897-3236, Dick Downey.

CIRCLE INQUIRY NO. 147

Miniature Selector Switch

A DIP socket compatible 10-position 1 pole 0-4 repeating selector switch has .100 x .300 centers. This -65 version of the 2300 Series MICRO-DIP occupies only one half of a 14-pin IC socket, or can be soldered directly to a printed circuit board.

Rockwell AIM 65
The Head-Start in Computers

AIM 65 Technical Overview

THERMAL PRINTER
Most desired feature on low-cost microcomputer systems . . .
- Wide 20-column printout
- Versatile 5 x 7 dot matrix format
- Complete 64-character ASCII alphanumeric format
- Fast 120 lines per minute
- Quiet thermal operation
- Proven reliability

FULL-SIZE ALPHANUMERIC KEYBOARD
Provides compatibility with system terminals . . .
- Standard 54 key, terminal-style layout
- 26 alphabetic characters
- 10 numeric characters
- 22 special characters
- 9 control functions
- 3 user-defined functions

TRUE ALPHANUMERIC DISPLAY
Provides legible and lengthy display . . .
- 20 characters wide
- 16-segment characters
- High contrast monolithic characters
- Complete 64-character ASCII alphanumeric format

PROVEN R6500 MICROCOMPUTER SYSTEM DEVICES
Reliable, high performance NMOS technology . . .
- R6502 Central Processing Unit (CPU), operating at 1 MHz. Has 65K address capability, 13 addressing modes and true index capability. Simple, but powerful 56 instructions.
- Read/Write Memory, using R2114 Static RAM devices. Available in 1K byte and 4K byte versions.
- 8K Monitor Program Memory, using R2332 Static ROM devices. Has sockets to accept additional 2332 ROM or 2532 PROM devices, to expand on-board Program Memory up to 20K bytes.
- R6532 RAM-Input/Output-Timer (RIOT) combination device. Multipurpose circuit for AIM 65 Monitor functions.
- Two R6522 Versatile Interface Adapter (VIA) devices, which support AIM 65 and user functions. Each VIA has two parallel and one serial 8-bit, bidirectional I/O ports, two 2-bit peripheral handshake control lines and two fully-programmable 16-bit interval timer/event counters.

BUILT-IN EXPANSION CAPABILITY
- 44-Pin Application Connector for peripheral add-ons
- 44-Pin Expansion Connector has full system bus
- Both connectors are KIM-1 compatible

TTY AND AUDIO CASSETTE INTERFACES
Standard interface to low-cost peripherals . . .
- 20 ma. current loop TTY interface
- Interface for two audio cassette recorders
- Two audio cassette formats: ASCII KIM-1 compatible and binary, blocked file assembler compatible

ROM-RESIDENT ADVANCED INTERACTIVE MONITOR
Advanced features found only on larger systems . . .
- Monitor-generated prompts
- Single keystroke commands
- Address independent data entry
- Debug aids
- Error messages
- Option and user interface linkage

ADVANCED INTERFACE MONITOR COMMANDS

Major Function Entry
(RESET Button)—Enter and initialize Monitor
ESC—Re-enter Monitor
E —Enter and initialize Text Editor
T —Re-enter Text Editor
N —Enter Assembler
5 —Enter and initialize BASIC Interpreter
6 —Re-enter BASIC Interpreter

Instruction Entry and Disassembly
I —Enter mnemonic instruction entry mode
K —Disassemble memory

Display/Alter Registers and Memory
* —Alter Program Counter to (address)
A —Alter Accumulator to (byte)
X —Alter X Register to (byte)
Y —Alter Y Register to (byte)
P —Alter Processor Status to (byte)
S —Alter Stack Pointer to (byte)
R —Display all registers
M —Displays four memory locations, starting at (address)
(SPACE)—Display next four memory locations
/ —Alter current memory location

Manipulate Breakpoints
—Clear all breakpoints
4 —Toggle breakpoint enable on/off
B —Set one to four breakpoint addresses
? —Display breakpoint addresses

Control Instruction/Trace
G —Execute user's program
Z —Toggle instruction trace mode on/off
V —Toggle register trace mode on/off
H —Trace Program Counter history

Control Peripheral Devices
L —Load object code into memory from peripheral I/O device
D —Dump object code to peripheral I/O device
1 —Toggle Tape 1 control on/off
2 —Toggle Tape 2 control on/off
3 —Verify tape checksum
CTRL PRINT—Toggle Printer on/off
LF —Line Feed
PRINT—Print Display contents

Call User-Defined Functions
F1 —Call User Function 1
F2 —Call User Function 2
F3 —Call User Function 3

Text Editor Commands
R —Read lines into text buffer from peripheral I/O device
I —Insert line into text buffer from Keyboard
K —Delete current line of text
(SPACE)—Display current line of text
L —List lines of text to peripheral I/O device
U —Move up one line
D —Move down one line
T —Go to top line of text
B —Go to bottom line of text
F —Find character string
C —Change character string
Q —Quit Text Editor, return to Monitor

LOW COST PLUG-IN ROM OPTIONS
- 4K Assembler — symbolic, two-pass
- 8K BASIC Interpreter

POWER SUPPLY SPECIFICATIONS
- + 5 VDC + 5% regulated @ 2.0 amps (max)
- +24 VDC + 15% unregulated @ 2.5 amps (peak) 0.5 amps (average)

AIM 65 (1K) $375.00 (*$15.00)
AIM 65 (4K) $450.00 (*$15.00)
Assembler ROM — Add $85.00
BASIC Interpreter — Add $100.00
Power Supply — Add $45.00
*Shipping and handling charge.
Calif. residents add 6% sales tax.

Rockwell's AIM 65 Advanced Interactive Microcomputer can get you into the exciting world of microcomputers a lot easier and at a lower cost than you may have thought possible. And you'll be working with the 6500 family, the advanced state-of-the-art NMOS system that's an everincreasing favorite for new commercial and hobbyist applications.

As a learning aid, AIM 65 gives you an assembled, versatile microcomputer system with a fullsize keyboard, 20-character display and, uniquely, a thermal printer. An on-board Advanced Interactive Monitor program provides extensive control and program development functions. And our AIM 65 User's Manual will help you along each step of the way.

You'll master fundamentals rapidly. Then you'll appreciate the fact that unlike the computer "toys" on the market, AIM 65 offers flexibility and expandability you would expect to find in a sophisticated microcomputer development system.

THERMAL PRINTER GIVES YOU HARD COPY — FAST AND QUIET.
AIM 65's 20-column Thermal Printer prints on low-cost, thermal roll paper at a fast 120 lines per minute. It produces all of the standard 64 ASCII characters with a crisp-printing five-by-seven dot matrix. AIM 65's on-board printer is a unique feature for a low-cost computer.

EXTENDED ALPHANUMERIC DISPLAY IS BUILT FOR UNDERSTANDING, NOT DECIPHERING.
AIM 65 comes with a 20-character true Alphanumeric Display. Information is displayed with bright, magnified 16-segment font monolithic characters. It's both unambiguous and easily readable.

FULL-SIZE KEYBOARD IS DESIGNED FOR HUMANS, NOT ELVES.
AIM 65's terminal-style keyboard frees you from the hassles of fumbling around with a tiny calculator-type keypad. And its 54 keys provide 70 different alphabetic, numeric, control and special functions.

ON-BOARD ADVANCED INTERACTIVE MONITOR GETS YOUR PROGRAMS UP AND RUNNING.
The ROM-resident AIM 65 Advanced Interactive Monitor Program provides a comprehensive set of easy-to-use, single-keystroke commands for debugging your programs, and offers features normally available only in larger, expensive microcomputer development systems. And with the AIM 65 Monitor, there's no guesswork involved; the Monitor gives a self-explanatory prompt when it needs information and it will generate a meaningful error message if an error has occurred.

The AIM 65 Monitor includes commands to
- Enter and edit programs directly — no "opcode" memorization
- List programs on Printer or TTY
- Display/alter registers and memory
- Set breakpoints, trace and debug program execution
- Control the Thermal Printer
- Transfer information to/from attached Cassette Recorders or TTY
- Execute programs in on-board or external RAM, ROM or PROM memory
- Interface the optional AIM 65 Assembler and BASIC Interpreter

AIM 65'S ADVANCED R6500 NMOS ARCHITECTURE.
The R6502 Central Processing Unit is the heart of the AIM 65. It provides demonstrated speed and simplicity, plus 65K addressability and the power of a 56-command, minicomputer-like instruction set.

The R6532 RAM-Input/Output-Timer (RIOT) combination device is used by the AIM 65 Monitor for scratchpad memory and Keyboard operations.

Two R6522 Versatile Interface Adapter (VIA) devices are provided. One device supports AIM 65's Thermal Printer and the TTY and Cassette Interfaces, the other supports two user-dedicated 8-line I/O ports, plus an 8-bit serial I/O port and access to two 16-bit interval timer/event counters, on the module's Application Connector.

AIM 65 comes with two R2332 4K Read Only Memory (ROM) devices installed. These hold the Advanced Interface Monitor program. Spare sockets allow the user to expand on-board ROM up to 20K bytes. These sockets will accept user programs on R2332 ROMs or compatible PROMs, or can be used to install the optional AIM 65 Assembler and BASIC Interpreter ROM devices.

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SOFTWARE

Screen-Oriented Text Editor

MATE is a powerful, screen-oriented text editor for 8080 or Z-80 microcomputers with floppy disks running under iCOM or TDL FDOS. MATE expands upon the capabilities of other text editors, while simplifying user interaction, by dividing the screen into text display and command string sections. TECO-like command strings use iteration, conditional branching, and macros to operate on 10 dynamically allocated buffers.

The independent text section of the screen instantly reflects any changes in the edit buffer, with text moving up and down, right and left, as commands modify the buffer. In another mode, keystrokes are directly entered on the screen and in the text. MATE can be used not only with a VDM-1, or similar video display board, but fast screen updates can also be obtained with a CRT terminal such as a Lear Siegler 'Dumb Terminal', because extensive display driver software utilizes the addressable cursor to make only necessary changes.

A wide variety of character, word, line and paragraph oriented commands are entered in the separately scrolling command section of the display. Command strings can range in complexity from a single character through full text editing programs.

MATE is available on 8" diskette for $49.50, including 9K bytes of object code for the editor, and object and source code for several popular screen, keyboard and printer drivers. The user and interface manual, which can be purchased separately for $5, refundable with complete order, gives instructions to help easily adapt these drivers to other hardware. For more information contact Aox Associates, P.O. Box 558, Somerville, MA 02143, Michael Aronson.

CIRCLE INQUIRY NO. 139

Multi-Keyed Indexed Sequential File Control

This Keyed Indexed Sequential Search (KISS) System developed by Tascon Corporation enables multi-key access to a user's disk files. KISS provides user selected variability of key and data lengths. The KISS System includes an Indexed Sequential File Manager (ISFM) and a Direct Access File Manager (DAFM). The system is implemented in assembler language to assure core and processing efficiency. The absolute maximum number of disk accesses to retrieve any record under control of KISS is three. KISS is designed to operate on the 8080/8085 and Z80 based systems.

Depending on key and data length, and user buffer space allocated, KISS produces record search and retrieval operations that are several orders of magnitude faster than currently available file methods. KISS is distributed as a relocatable object module on user specified formatted floppy disk. Currently, configurations are available for IMSAI (DOS-A) and ISIS-II using PL/M, FORTRAN, assembler, and Extended BASIC.

The six section illustrated user guide that includes technical concept, user interface control, and actual file control code examples, is included in the price of $485. The user guide can be purchased separately for $22.50 plus $2.50 for postage and handling. For information, contact the distributor: EIDOS Systems Corporation, 315 Wilhagan Road, Nashville, TN 37217, (615) 385-0632.

CIRCLE INQUIRY NO. 140

LITERATURE

Application Note on Troubleshooting

An application note describing the debugging of a microprocessor-based industrial control system using a logic analyzer describes how the Tektronix 7D01 Logic Analyzer, with digital latch capability, was used to isolate a malfunction in the fault detecting circuits of a high speed winder for wrapping core material from rotating spools.

Extensive electrical schematics and diagrams of the Delay Line Winder fault detecting system are included in the application note as well as a listing of the Tektronix 7D01 logic analyzer's features such as 16-channel data acquisition, synchronous or asynchronous, for both software and hardware measurements; word recognition; and automatic data comparison.

For a copy of the Application Note #57K4.0, contact Tektronix, Logic Development Products, P.O. Box 500, Beaverton, OR 97077, (503) 644-0161. CIRCLE INQUIRY NO. 141

New Booklet on Installing Your Own Telephone Equipment

"How to Buy, Install and Maintain Your Own Telephone Equipment" is the title of a new booklet designed to help consumers and businesses cut the costs of telephone and related telephone equipment. This is possible because of recent rulings which allow users to replace specific items of telephone equipment with privately purchased equipment.

In a compact paperback, two independent telephone installation engineers, Joseph La Carrubba and Louis Zimmer give a detailed, easy-to-follow description of the steps for purchasing, installing, and maintaining privately owned telephone equipment. Easy-to-read diagrams and illustrations of the basic telephone parts show where existing equipment can be replaced and new equipment installed as remodeling or new construction is completed.

The contents also give a thorough explanation of dial, pushbutton, and party line telephone systems, how they operate, simple planning and installation information, and step-by-step descriptions for installation of equipment. In addition, a list of a few required tools, one easy-to-build item of test equipment, and maintenance information to ensure servicing of the equipment.

The new 52-page booklet sells for $3.00 postpaid, payment with order. Send check or money order to Almar Press, Dept. B, 4105 Marietta Dr., Binghamton, NY 13903.

CIRCLE INQUIRY NO. 142

The Channel Data Book

Channel Data Systems will publish a comprehensive hardware/software reference service for users of the Commodore PET™ personal computer. The Channel Data Book is a user-oriented directory of PET-related products including software, hardware and peripherals, literature and periodicals of special interest to PET users, listings of user groups and distributors, and cross references by product type and supplier.

Designed as a personalized working tool, the Channel Data Book provides a complete reference service for PET-related products, plus convenient dividers and color coding to organize programs, articles, and newsletters of specific interest to each user.

Special sections for filing correspondence you have received from Commodore and flyers from other product suppliers are also provided.

The Data Book includes an attractive 3-ring binder and updated supplements with easy to follow instructions for filing new and revised material. The price of $19.95 includes the Channel Data Book and update service through calendar year 1979. To order or for more information contact Channel Data Systems, 5960 Mandarin Ave., Goleta, CA 93017, (805) 964-6695.

CIRCLE INQUIRY NO. 143

BOOK REVIEWS

A PEOPLE'S DATA BASE SYSTEM

By Madan L. Gupta and Brent Lander. $14.95

Review by David L. Buckhout

The "People's Data Base System" is a fairly versatile database and was developed on an Altair 8080B. This indicates that the database system is compatible on a microcomputer, although the file management is the key to the magnitude of the data base.

The first thing that I associate with a database is a company with tens of thousands of tapes in their library. *A People's Data Base System* gives a totally different picture. At the very beginning, this book gives a brief summary of some basic syntax and structure.

There are four sections. First is a brief explanation of a database. Second is the aforementioned basic. Third is an explanation of each source code module. And finally there is a section of examples and implementation.

The first two sections are trivial, but the third section is actual documentation on the accompanying source code. The fourth section does include some good examples on implementation of this data base for both the commercial and hobbyist users.

This book is just a manual and documentation for the "People's Data Base System." Since this manual also includes the source code, I hope it explains the price because I read through the manual's 121 pages in about thirty minutes.

The manual is not very complex and should only be considered as a reference to the implementation of the "People's Data Base System". In order to fully implement this software it is also necessary to develop your own mass storage management system so that the newly generated data base will not be lost.

The examples give a plausible case for using a database for the hobbyist and the commercial users, with examples of balancing a checkbook and doing payroll for each case respectively. These examples exemplify the fact that this database is reasonably flexible. It has the ability to specify the number of data fields (either alphanumeric or numeric), sort fields, insert an item, delete, search, average, variance, covariance and easy modification.

If one wants source code and documentation of a database system that is not too sophisticated, *A People's Data Base System* should fill your needs adequately.□

AN INTRODUCTION TO PERSONAL AND BUSINESS COMPUTING

By Rodnay Zaks
Sybex, Berkeley, CA.

Review by Roger H. Edelson, Hardware Editor

This book is definitely an *introductory* text into the world of personal and business computing. Though it is simple, it does present a detailed and comprehensive picture of the concepts, techniques, and the peripherals used in the microprocessor world. Although it does not require a technical or electronic background, even more advanced readers will derive some benefit from the book.

Chapter 2 is an extremely elementary look at using a microprocessor system, but you get some feel for actively sitting at a keyboard and accessing your program.

Chapter 3 does a good job of presenting basic definitions. This information is provided in a conversational manner, not as the more common alphabetical list, and as such it is very readable. Chapter 4 presents a surprisingly adept discussion of the operational/architectural aspects of the microprocessor while remaining at the beginners level.

Chapters 5 and 6 explore the programming of the microcomputer. BASIC and APL are discussed and compared in some detail, while machine language is given short shift (probably rightfully so, considering the intended reader level).

The chapter on business computing (Chapter 7) is a broad brush introduction to the rather large field of business oriented applications of microprocessors. As such, it only whets your appetite.

Chapters 8, 9 and 10 are intended to provide information in selecting a system. The information is quite timely and up-to-date.

The next two chapters (11 and 12) contain a wealth of information concerning the economics of a business system and the reliability/failure problems associated with computers.

Chapter 13 provides some material on where the novice can go to obtain more information and help. It could have been left out, as could Chapter 14, which is intended to summarize the book and provide a glimpse into the future.

The information in the Appendices is useful considering the level of the book.

In general the text does a worthwhile job of presenting a beginning level introduction to microcomputers for mainly business applications.□

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PS Form Apr. 1976 3526 (Page 1) (See instructions on reverse)

PEEK and POKE A Total

By Douglas L. Jones

While the program described here is essentially to add two numbers and print the total, it will be found that some of the inherent intricacies of BASIC can be rearranged. The program was written for an Altair 680 using its unique forms of BASIC. It is doubtful that the Altair 680 is the most predominant hobbyist-owned computer, so use this program as a model for the version of BASIC on any particular computer.

The annoying part about BASIC that initiated this programming effort is the prompting question mark (?) that always accompanies an INPUT statement. Consider the following examples:

```
  10 INPUT A
  RUN
  ? 5 (CR)                 (A rather normal example.)
(LF)

  10 INPUT A
  RUN
  ? 5,6,7 (CR)
(LF) EXTRA IGNORED         (Only one data element was
                           input.)

  10 INPUT A,B.C
  RUN
  ? 5,6 (CR)
(LF)??                     (BASIC is not satisfied. It
                           wants a third element of
                           data input.)
```

It is easy to relate to those examples with any version of BASIC. If it's only a few variables that data must be typed in for, the responses (like the examples) are bearable. But what if one is given a rather lengthy paper tape with unknown hundreds of numbers to be figured? The prompting question mark and carriage return followed by the automatic line feed become rather annoying and paper consuming.

The paper tape with raw data actually used with this program was previously prepared from an external source. Its format was an unknown number of lines, each with a varying amount of data elements. The data elements were separated on any one line by a space. All lines are terminated by a carriage return, line feed, and 2 rubouts.

To better understand the program, first the 680 hardware involved should be explained. The computer is a stock Altair 680-B with an additional 16K memory board. The output port, a UART, is connected to a model 33-ASR Teletype®. One of the outputs of the UART is a request-to-send lead. Since the computer is not used in data-set applications, this RTS lead is a convenient form of control for the paper tape reader on the Teletype. A simple single-contact normally open miniature relay is used to convert and isolate the logic environment of the 680 from the high-voltage and spike-filled world of the paper tape reader.

Since the limiting factor in BASIC appeared to be the question mark, it would be a simple matter to NOP or NULL out this character. Rather than NOP the question mark, the actual subroutine call that outputs *anything* was NOPed. This, then, eliminates the question mark, the line feed, and will also kill all echo as data comes in from the reader. This is a distinct advantage in improving the throughput of the system and saves on paper.

The following line description is helpful in understanding the program:

10/20 Since there are two versions of BASIC for the 680, each must be accommodated. The subroutine call JSR OUTCH (HEX BD FF 81) is desired. The program homes in on the FF by looking for the decimal equivalent 255. Once found, the address pointer is stored in variable A.

30 An array is dimensioned and by using the PEEK command, the subroutine call is read into the array.

40 The subroutine is NOPed with a hexadecimal 01.

50 The paper tape reader is turned on, one *line* of data is read into string A$, and the paper tape reader is then turned off. This paper tape reader manipulation must be done to allow BASIC time to process the string input.

60 If the line contains the single word "ON" (hand typed after the tape is done running), that is the indication that there is no more data.

70 If the line length is 1, accept it as a single digit on the line and add to the total.

80/90 Inspect the line looking for the first SPACE following a data element. Once found, add the segregated element to the total.

100 Add the string value isolated to total.

110 Replace string with truncated value. Example: if A$ is 13 14 15, then replace A$ with 14 15.

120 Continue searching string for next SPACE.

130 Add a straight number to total. Go back for more data.

140 POKE original subroutine call back to BASIC. This will turn on all printing and echo.

150 Print totalized value and end.□

PROGRAM LISTING

```
10 IFPEEK(2222)=255THENA=2221:REM ALTAIR 680 BASIC V1.0 R3.2
20 IFPEEK(2236)=255THENA=2235:REM ALTAIR 680 CSAVE BASIC
30 DIMV(2):FORN=0TO2:V(N)=PEEK(A+N):NEXT
40 FORN=0TO2:POKEA+N,01:NEXT
50 POKE61440,209:INPUTA$:POKE61440,177
60 IFA$="ON"THEN140
70 IFLEN(A$)=1THEN130
80 FORN=2TOLEN(A$):IFMID$(A$,N,1)=" "ANDN<LEN(A$)THEN100
90 NEXTN:GOTO130
100 T=T+VAL(LEFT$(A$,N-1))
110 IFLEN(A$)<>1THENA$=MID$(A$,(N+1),LEN(A$)-N)
120 GOTO80
130 T=T+VAL(A$):GOTO50
140 FORN=0TO2:POKEA+N,V(N):NEXT
150 PRINT"TOTAL IS";T:END
OK
```

CP/M: 8080/Z-80 Disk

Part 2: A Macro Assembler

Review by Alan R. Miller,

INTRODUCTION

CP/M is a complete disk operating system (DOS) for an 8080 or Z-80 microcomputer. The standard Digital Research version is available on an 8-inch soft-sectored floppy diskette. There are also versions for the North Star and Micropolis 5-inch, hard-sectored floppies.

The operation of CP/M with its editor (ED), assembler (ASM), and debugger (DDT) was described in the July, 1978, issue of INTERFACE AGE. This article will deal with the macro assembler (MAC), an improved debugger (SID), a compiler BASIC (BASIC-E), and a sample interface program (BIOS).

USING LOWER CASE

The CP/M manual mentions that lower case letters can be used. But when lower case letters were entered with the editor, they were always converted to upper case. However, if a lower-case i is used for the insert command, both upper and lower case letters can be entered. Similarly, a lower-case f or s can be used to find strings containing lower case letters. The command:

```
*msFirst^zSecond^z0tt
```

will substitute every occurrence of First with Second and print the changed lines. The ^z symbol means Control-Z.

A MACRO ASSEMBLER CALLED MAC

The regular assembler that comes with CP/M is called ASM. It can assemble source programs of type .ASM to produce an Intel HEX checksummed object file of type .HEX, and an assembly listing of type .PRN. The PRN file contains both the original source program and an ASCII hexadecimal representation of the object program.

ASM recognizes the standard Intel 8080 operation codes and the pseudo-ops DB, DW, DS, ORG and IF. . . ENDIF. The operations:

+	–	*	/
AND	OR	NOT	XOR
SHR	SHL	(	)

can be performed on operands to make the source program easier to understand.

Digital Research now has available a CP/M macro assembler called MAC which is upwardly compatible with ASM. MAC introduces several new operations:

a	MOD	b	moduluo operation
a	EQ	b	TRUE if a equals b
a	LT	b	TRUE if a less than b
a	GT	b	TRUE if a greater than b
a	LE	b	TRUE if a less than or equal to b
a	GE	b	TRUE if a greater than or equal to b
HIGH		STRT	the high 8 bits of STRT
LOW		STRT	the low 8 bits of STRT

(FALSE has the numeric value of zero and TRUE the value of – 1, i.e. NOT FALSE.) There are also several new directives (pseudo-ops):

PAGE	set page length for PRN files
TITLE	print title and page number
ELSE	used between IF. .ENDIF

MACROS

The best feature of the new assembler is a macro processor which can greatly simplify assembly language programming. It is the nature of assembly language programs that similar blocks of instructions are required in several places. If the instructions for these blocks are identical, they can be replaced by a subroutine to be

An Operating System
and Other Goodies

Contributing Editor

called from wherever it is needed. If the blocks contain different instructions that are similarly structured, they can be coded with a macro.

A macro defines a prototype block of operations with dummy variables for the instructions that will be different from one usage to the next. The ultimate, assembled object code will be the same whether coded with a macro or not, but the source code can be significantly shortened and easier to understand.

As an example of the use of macros, consider the following three output routines, first coded directly, then coded with a macro.

```
COUT:   IN      CSTAT     ;CONSOLE OUTPUT ROUTINE
        ANI     COMSK     ;MASK FOR OUTPUT BIT
        JZ      COUT      ;LOOP UNTIL READY
        MOV     A,C
        OUT     CDATA     ;PRINT THE BYTE
        RET
;
LOUT:   IN      LSTAT     ;LIST-OUTPUT ROUTINE
        ANI     LOMSK     ;MASK FOR OUTPUT
        JZ      LOUT
        MOV     A,C       ;GET BYTE
        OUT     LDATA     ;SEND TO LIST
        RET
;
TOUT:   IN      TSTAT     ;TAPE OUTPUT ROUTINE
        ANI     TOMSK     ;MASK FOR OUTPUT
        JNZ     TOUT
        MOV     A,C       ;GET BYTE
        OUT     TDATA     ;SEND TO TAPE RECORDER
        RET
```

The above three output routines can be generated with a single macro:

```
OUTPUT  MACRO   Y,Z       ;;OUTPUT ROUTINE
        IN      Y&STAT    ;CHECK STATUS
        ANI     Y&OMSK    ;MASK FOR OUTPUT
        J&Z     $-4       ;LOOP UNTIL READY
        MOV     A,C       ;MOVE BYTE TO A
        OUT     Y&DATA    ;SEND IT
        RET
        ENDM
```

This macro appears at the beginning of the program and is invoked at the appropriate places:

```
COUT:   OUTPUT  C,Z       ;CONSOLE-OUTPUT
        . .
LOUT:   OUTPUT  L,Z       ;LIST OUTPUT
        . .
TOUT:   OUTPUT  T,NZ      ;TAPE OUTPUT
```

In this case the macro was named OUTPUT with dummy arguments Y and Z. (Be sure not to use register names such as C for dummy arguments if the registers are used in the macro.) At assembly time, the dummy arguments replace the real arguments, and the & symbols are removed if they are next to a dummy argument. Notice that the second argument sets up a JZ for the first two routines and a JNZ for the third.

Comments which pertain only to the macro can be preceded by two semicolons. They will then not appear in the expansion. On the other hand, comments preceded by a single semicolon will be reproduced at each macro expansion.

Macros that are frequently used for different programs can be placed into a separate file of type .LIB and referenced by a single statement:

```
MACLIB  libname
```

For example, the MAC diskette comes with a file of macros that generate Z-80 instructions. The statement:

MACLIB Z80

will direct the assembler to include these macros as needed.

THE REPEAT MACROS

The repeat macros can be used to duplicate a block of code. The straight repeat REPT, the repeat character REPC and the indefinite repeat IRP are in-line macros that are placed where they are needed. They can be combined with regular macros and conditional directives to increase their power. The following example can be used to generate a carriage return/line feed routine with the proper number of nulls.

```
NNULS   EQU     3
CR      EQU     ODH         ;CARRIAGE RETURN
LF      EQU     OAH         ;LINE FEED
        ..
        ..
CRLF:   MVI     A,CR        ;GET CARRIAGE RETURN
        CALL    OUTT        ;SEND IT
        MVI     A,LF        ;GET LINE FEED
        IF      NNULS>0     ;SKIP IF NO NULLS
        CALL    OUTT
        XRA     A           ;GET A ZERO
        REPT    NNULS-1     ;DO NULLS
        CALL    OUTT
        ENDM                ;END OF REPT
        ENDIF               ;END CONDITIONAL
        JMP     OUT
```

ASSEMBLY-TIME OPTIONS

The assembler MAC is invoked a little differently from ASM. There are eight parameters which can be specified following the $ symbol. For example, the command:

MAC PROM $+S

will assemble the file PROM.ASM from the current disk, place the .PRN and .HEX files on the same disk, and append the symbol table to the .PRN file. The command:

MAC PROM $ AB HC PP +S LA

will assemble the .ASM file from disk drive B using macro libraries on disk A, place the HEX file on disk C, and send the assembly listing and symbol table to the list device.

USING MAC ON A TELETYPE

MAC is designed for a list device that can print 80 characters on a line. If the list device is a Teletype with a width of 72 characters, the symbol table produced by MAC will be unreadable in the far right column. The solution is simple: reduce the number of columns in the symbol table from five to four. Load MAC with SID:

SID MAC.COM

then use SID to change the instruction at 1100 HEX. First inspect the location with the L command:

```
#L1100
#1100   CPI   50
```

then change the 50 to a 40:

```
#A1100
1100   CPI   40
```

Now, save the patched version of MAC. Put another diskette into the drive if only one is available, do a cold start with a Control-C, then give the save command:

SAVE 48 MAC72.COM

It's easier, of course, if there is more than one disk. Assembly with this patched version is the same except for the spelling of the name:

MAC72 PROM $+S

A SAMPLE CP/M BIOS

One thing necessary to get CP/M up and running is to write the interface routines for the peripherals. This part of CP/M is called BIOS (basic input/output system). The BIOS used on the Lifeboat version of CP/M is shown in the program listing. It provides for interfaces to a console, line printer, VDM, and telephone modem to connect one computer to a larger computer. Output is directed to the desired peripheral by setting the appropriate front-panel switches. This can even be done during output. An additional option is whether the modem output is half or full duplex.

Notice that the macros called OUTPUT and INPUT are used to generate the appropriate output and input code. The lines generated by macros have a plus symbol between the address and the instruction.

If the TITLE directive is used with MAC, the .PRN file will contain a form feed character (Control-L) at the beginning of each page. Fancy printers are designed to skip to the next page in this case. If a DECwriter or Teletype is the list device, a form feed must be simulated by counting lines. The BIOS shown in the listing does this task. Whenever a Control-L is encountered, two lines are skipped, a minus is printed (as a guide to folding the paper), then two more lines are skipped. This produces list output for the .PRN files that is 11 inches long.

SYMBOLIC INSTRUCTION DEBUGGER CALLED SID

The CP/M debugger called DDT has been improved and renamed SID. It can perform all of the usual monitor functions such as display memory in HEX and ASCII, load memory, set break points, jump to an absolute address, block move, block fill, disassemble memory, and directly assemble single instructions (a hot-patch assembler).

SID has additional features linked to the new MAC assembler. For example, the symbol table generated by MAC can be loaded along with the object program as an aid in debugging. Symbolic instructions can be given with respect to the labels in the symbol table and their corresponding addresses.

SID can be used to load any type of program from disk into memory starting at the transient program area (TPA) at 100 HEX. This makes it much easier to copy files from one diskette to another if only one disk drive is available. (Since CP/M mostly works from one disk file to another, it would be better to invest in additional drives rather than in additional memory.)

With two drives, a file can be copied from one drive to the other with PIP. The command:

PIP A:NEWFILE=B:OLDFILE

copies a file from drive B to drive A. With a single drive the copying can be done with SID. Give the commands:

SID

(change diskettes if necessary to the one with the old file). Then type:

```
#Ioldfilename
#R
```

SID will respond with a hexadecimal number that is 100 HEX greater than the file length. Change to the final diskette and type a Control-C to do a warm start. Then type:

SAVE XX newfile

where XX is the decimal number of 256-byte blocks. The number of blocks can be determined from the SID response to the R command.

SID UTILITIES

The SID diskette comes with two utility routines HIST and TRACE. The HIST routine produces a histogram of the relative frequency that various portions of a program are executed. TRACE allows tracing backwards from a breakpoint the path a program has taken.

A COMPILER BASIC

BASIC is a name that covers all kinds of things from Tiny BASIC to MITS extended disk BASIC. When one is ordered, a paper tape, magnetic tape or disk with the object program on it is received. It loads into anywhere from 4K to 20K bytes of memory and stays there all the while it is used. A source program is entered on top of BASIC, then executed with the command RUN. This type of BASIC program is an interpreter since it doesn't do anything to the program. BASIC interprets each statement of the program each time it encounters it. A statement in a loop that is executed 100 times has to be interpreted 100 times.

BASIC-E is different. It actually consists of two 12K byte programs called BASIC and RUN. First a source program of type .BAS is created by using the CP/M editor. Next the BASIC-E compiler is executed with the statement:

```
BASIC   PROGRM
```

where PROGRM is the program name. The compiler uses the source program to produce an intermediate file of type .INT and puts it onto the disk. The intermediate program can be run by typing:

```
RUN   PROGRM
```

The compiled program can be run again and again without a re-interpretation of the original source program.

BASIC-E has all the commands of an extended BASIC plus some additional features. Variable names can be up to 31 characters long. No more problems with SUMX, SUMY, and SUMXY in linear curve fitting. Another nice feature is that line numbers are only needed on lines that are branched to from other places. And the numbers don't have to be in increasing order. This makes the source program look a little like FORTRAN.

Since a single statement can be spread over several lines by placing a back slash at the end of each continuation line, the source program can be very easy to read. Blank lines can also be used freely.

```
REMARK \
           FIRST COMPARISON

IF         APPLE  =  ORANGE  \
THEN         DOG  =  CAT     \
ELSE         BOY  =  G I R L
```

Data can be read from disk files and generated data can be written to disk files. These files can be blocked or unblocked, so that data can be read either randomly or sequentially.

One disadvantage of a compiler BASIC is that debugging is more difficult. With an interpretive BASIC, the program can be interrupted (usually with a Control-C), and the values of the variables can be printed out. Then the program can be continued with a CONT statement. CBASIC is a more powerful version of BASIC-E, containing a PRINT USING command for output formatting and 14-figure precision. CBASIC will be reviewed in the near future.□

PROGRAM LISTING

```
                ; BIØS:   USER I/Ø FØR LIFEBØAT CP/M
                ;         ØN NØRTH STAR DISK
                ;
                ;
                ; PRØGRAMMED FØR AN 8080 MICRØPRØCESSØR
                ; BY ALAN R. MILLER
                ; NEW MEXICØ TECH, SØCØRRØ, NM  87801
                ;  505-835-5619              MAY 15, 1978
                ;
                ; TERMINAL DEVICES SUPPØRTED:
                ;
                ;                   ADDRESS (HEX)     CØMMNENT
                ;  CØNSØLE             10/11          3 NULLS
                ;  LIST DEVICE         12/13          TELETYPE
                ;  MØDEM               14/15          HALF ØR FULL DUPLEX
                ;  CASSETTE TAPE       6/7
                ;  VDM DRIVER          C8             PRØCESSØR TECH
                ;
                ;  FRØNT PANEL SWITCHES SELECT PERIPHERAL:
                ;
                ; ALL DØWN SELECT CØNSØLE INPUT, VDM ØUTPUT, TTY LIST
                ; A9   UP FØR MØDEM I/Ø
                ; A10  UP FØR ACR CASSETTE I/Ø
                ; A11  UP FØR HALF DUPLEX ØN MØDEM, DØWN FØR FULL
                ;
                ; FØR MØDEM, USE PIP
                ;   A>PIP   LST:=A:FILENAME
                ; RAISE A9 AFTER CARRIAGE RETURN, LØWER WHEN DØNE
                ;
0000 =          FALSE   EQU     0
FFFF =          TRUE    EQU     NØT FALSE
                ;
FFFF =          PERCØM  EQU     TRUE      ;PERCØM VS. MITS MØDEM
                ;
0028 =          MSIZE   EQU     40        ;CP/M MEMØRY SIZE IN DECIMAL K
                ;
A400            ØRG     MSIZE * 1024 + 400H
                ;
0003 =          NNULL   EQU     3         ;NUMBER ØF CØNSØLE NULLS
FFFF =          VDM     EQU     TRUE      ;VDM VERSIØN
F805 =          VDMØUT  EQU     0F805H    ;VDM ØUTPUT, BYTE ØN STACK
0010 =          CSTAT   EQU     10H       ;CØNSØLE STATUS
0011 =          CDATA   EQU     CSTAT+1   ;CØNSØLE DATA
0012 =          LSTAT   EQU     12H       ;LIST STATUS
0013 =          LDATA   EQU     LSTAT+1   ;LIST DATA
0006 =          TSTAT   EQU     6         ;MAGNETIC TAPE
0007 =          TDATA   EQU     TSTAT+1
0014 =          MSTAT   EQU     14H       ;MØDEM
0015 =          MDATA   EQU     MSTAT+1
                        IF      PERCØM
0040 =          MIMSK   EQU     40H       ;MØDEM INPUT MASK
                        TITLE   'FØR PERCØM MØDEM'
                        ELSE
                MIMSK   EQU     1
                        TITLE   'FØR MITS MØDEM'
                        ENDIF
0001 =          CIMSK   EQU     1         ;CØNSØLE INPUT MASK
0001 =          LIMSK   EQU     1         ;LIST INPUT MASK
0001 =          TIMSK   EQU     1         ;MAG TAPE INPUT MASK
0080 =          MØMSK   EQU     MIMSK*2   ;MØDEM ØUTPUT MASK
0002 =          CØMSK   EQU     CIMSK*2   ;CØNSØLE ØUTPUT MASK
0002 =          LØMSK   EQU     LIMSK*2   ;LIST ØUTPUT MASK
0080 =          TØMSK   EQU     80H       ;TAPE ØUTPUT MASK
```

Branched to Page 134

Vectored from Page 133

```
00FF =              SSW     EQU     255         ;FRØNT-PANEL SWITCHES
0015 =              STØPC   EQU     15H         ;CØNSØLE = 1 STØP BIT
0011 =              STØPL   EQU     11H         ;LIST = 2  STØPS BITS
000D =              CR      EQU     13
000A =              LF      EQU     10
000C =              FFEED   EQU     12          ;FØRM FEED IS CØNTRØL-L
                    ;
                    ØUTPUT  MACRØ   Y,Z         ;;MACRØ FØR ØUTPUT
                            IN      Y&STAT      ;CHECK STATUAS
                            ANI     Y&ØMSK      ;MASK FØR ØUTPUT
                            J&Z     $-4         ;LØØP UNTIL READY
                            MØV     A,C         ;GET BYTE
                            ØUT     Y&DATA      ;ØUTPUT IT
                            ENDM
                    ;
                    INPUT   MACRØ   Y,Z         ;;MACRØ FØR INPUT
                            IN      Y&STAT
                            ANI     Y&IMSK      ;MASK FØR INPUT
                            J&Z     $-4         ;LØØP UNTIL READY
                            IN      Y&DATA
                            ENDM
                    ;
A400 C315A4                 JMP     INIT        ;INITIALIZATIØN
A403 C341A4                 JMP     CØNST       ;CØNSØLE STATUS
A406 C349A4                 JMP     CØNIN       ;CØNSØLE INPUT
A409 C355A4                 JMP     CØNØUT      ;CØNSØLE ØUTPUT
A40C C37AA4                 JMP     LØUT        ;LIST ØUTPUT
A40F C37AA4                 JMP     LØUT        ;PUNCH ØUTPUT
A412 C3BFA4                 JMP     READR       ;READER INPUT
                    ;
A415 3E03           INIT:   MVI     A,3
A417 D310                   ØUT     CSTAT       ;RESET ACIA
A419 D312                   ØUT     LSTAT
                            IF      NØT PERCØM
                            ØUT     MSTAT       ;RESET MITS MØDEM
                            MVI     A,STØPC
                            ØUT     MSTAT       ;SET MØDEM STØP BITS
                            ENDIF
A41B 3E15                   MVI     A,STØPC
A41D D310                   ØUT     CSTAT       ;SET CØNSØLE STØP BITS
A41F 3E11                   MVI     A,STØPL
A421 D312                   ØUT     LSTAT       ;SET LIST  TØP BITS
A423 AF                     XRA     A           ;INITIALIZATIØN RØUTINE
A424 320300                 STA     3           ;RESET CP/M DRIVE TØ A
                            IF      PERCØM
A427 D314                   ØUT     MSTAT       ;RESET PECØM MØDEM
                            ENDIF
A429 3A37A5                 LDA     IFLAG       ;CHECK INITIALIZATIØN FLAG
A42C FE23                   CPI     '#'         ; # MEANS ALREADY INITIALIZED
A42E C8                     RZ                  ;SØ SKIP THE REST
A42F 3E23                   MVI     A,'#'
A431 3237A5                 STA     IFLAG       ;SET FLAG
A434 2121A5                 LXI     H,SIGNØN    ;PØINT TØ SIGNØN MESSAGE
A437 7E             MESG:   MØV     A,M
A438 B7                     ØRA     A           ;ZERØ FØR LAST BYTE
A439 C8                     RZ                  ;DØNE
A43A CD56A4                 CALL    CØNØUT+1    ;PRINT SIGN-ØN MESSAGE
A43D 23                     INX     H
A43E C337A4                 JMP     MESG        ;NEXT CHARACTER
                    ;
                    ; RØUTINE TØ CHECK CØNSØLE INPUT STATUS
                    ;
A441 DB10           CØNST:  IN      CSTAT       ;GET STATUS
A443 E601                   ANI     1           ;MASK FØR INPUT
A445 C8                     RZ                  ;INPUT NØT READY
A446 3EFF                   MVI     A,TRUE      ;FF HEX MEANS READY
A448 C9                     RET
                    ;
```

```
                    LIST:   ØUTPUT  L,Z
A491+DB12                   IN      LSTAT       ;CHECK STATUAS
A493+E602                   ANI     LØMSK       ;MASK FØR ØUTPUT
A495+CA91A4                 JZ      $-4         ;LØØP UNTIL READY
A498+79                     MØV     A,C         ;GET BYTE
A499+D313                   ØUT     LDATA       ;ØUTPUT IT
A49B FE0C                   CPI     FFEED       ;FØRM FEED?
A49D C0                     RNZ                 ;NØ
A49E CDA6A4                 CALL    LSKIP       ;SKIP FØUR LINES
A4A1 0E2D                   MVI     C,'-'       ;MARK PLACE TØ
A4A3 CD91A4                 CALL    LIST        ; FØLD PAPER
A4A6 C5             LSKIP:  PUSH    B
A4A7 0E0A                   MVI     C,LF
A4A9 0604                   MVI     B,4
A4AB CD91A4                 CALL    LIST
A4AE 05                     DCR     B
A4AF C2ABA4                 JNZ     $-4
A4B2 C1                     PØP     B
A4B3 C9                     RET
                    ;
                    ; ØUTPUT TØ MØDEM, A 11 UP FØR HALF DUPLEX
                    ;
                    MØUT:   ØUTPUT  M,Z
A4B4+DB14                   IN      MSTAT       ;CHECK STATUAS
A4B6+E680                   ANI     MØMSK       ;MASK FØR ØUTPUT
A4B8+CAB4A4                 JZ      $-4         ;LØØP UNTIL READY
A4BB+79                     MØV     A,C         ;GET BYTE
A4BC+D315                   ØUT     MDATA       ;ØUTPUT IT
A4BE C9                     RET
                    ;
                    ; INPUT FØR READR
                    ; A9 UP FØR MØDEM, A10 UP FØR CASSETTE
                    ;
A4BF DBFF           READR:  IN      SSW         ;CHECK FRØNT PANEL
A4C1 E606                   ANI     6           ;A9, A10 UP?
A4C3 CAE1A4                 JZ      LIN         ;NØ, LIST INPUT
A4C6 E602                   ANI     2           ;A9 UP?
A4C8 C2D5A4                 JNZ     MIN         ;MØDEM INPUT
                    ;
                    ; MAGNETIC TAPE INPUT
                    ;
                    AIN:    INPUT   T,NZ
A4CB+DB06                   IN      TSTAT
A4CD+E601                   ANI     TIMSK       ;MASK FØR INPUT
A4CF+C2CBA4                 JNZ     $-4         ;LØØP UNTIL READY
A4D2+DB07                   IN      TDATA
A4D4 C9                     RET
                    MIN:    INPUT   M,Z         ;MØDEM INPUT
A4D5+DB14                   IN      MSTAT
A4D7+E640                   ANI     MIMSK       ;MASK FØR INPUT
A4D9+CAD5A4                 JZ      $-4         ;LØØP UNTIL READY
A4DC+DB15                   IN      MDATA
A4DE E67F                   ANI     7FH         ;MASK PARITY
A4E0 C9                     RET
                    ;
                    ; INPUT FRØM TELETYPE
                    ;
                    LIN:    INPUT   L,Z
A4E1+DB12                   IN      LSTAT
A4E3+E601                   ANI     LIMSK       ;MASK FØR INPUT
A4E5+CAE1A4                 JZ      $-4         ;LØØP UNTIL READY
A4E8+DB13                   IN      LDATA
A4EA C9                     RET
                    ;
                    ; MØDEM ØUTPUT.  A11 DØWN FØR FULL DUPLEX.
                    ; WAIT FØR CARRIAGE RETURN FRØM MØDEM
                    ; AFTER SENDING A CARRIAGE RETURN.
                    ;
```

```
                ;  CØNSØLE-INPUT RØUTINE
                ;
                CØNIN:  INPUT   C,Z
A449+DB10               IN      CSTAT
A44B+E601               ANI     CIMSK   ;MASK FØR INPUT
A44D+CA49A4             JZ      $-4     ;LØØP UNTIL READY
A450+DB11               IN      CDATA
A452 E67F               ANI     7FH     ;MASK PARITY
A454 C9                 RET
                ;
                ;  CØNSØLE ØUTPUT RØUTINE
                ;
                CØNØUT: IF      VDM
A455 79                 MØV     A,C
A456 F5                 PUSH    PSW
A457 DBFF               IN      255     ;CHECK FRØNT PANEL
A459 1F                 RAR             ;IS A 8 UP?
A45A D205F8             JNC     VDMØUT  ;ØUTPUT TØ VDM
A45D F1                 PØP     PSW     ;GET BYTE FRØM STACK
                        ENDIF
                CØNW:   ØUTPUT C,Z
A45E+DB10               IN      CSTAT   ;CHECK STATUAS
A460+E602               ANI     CØMSK   ;MASK FØR ØUTPUT
A462+CA5EA4             JZ      $-4     ;LØØP UNTIL READY
A465+79                 MØV     A,C     ;GET BYTE
A466+D311               ØUT     CDATA   ;ØUTPUT IT
                        IF      NNULL>0 ;SKIP IF NØ NULLS
A468 FE0D               CPI     CR      ;CARRIAGE RETURN?
A46A C0                 RNZ             ;NØ
                ;
                ; ADD DELAY FØR CARRIAGE RETURN
                ;
A46B D5                 PUSH    D
A46C 165A               MVI     D,30 * NNULL
A46E 1EFA       ØUTCR:  MVI     E,250
A470 1D                 DCR     E
A471 C270A4             JNZ     $-1     ;INNER LØØP
A474 15                 DCR     D
A475 C26EA4             JNZ     ØUTCR   ;ØUTER LØØP
A478 D1                 PØP     D
                        ENDIF
A479 C9                 RET
                ;
                ; ØUTPUT FØR BØTH LIST AND PUNCH
                ; A9 UP FØR MØDEM ØUTPUT
                ; A10 UP FØR CASSETTE TAPE
                ;
A47A DBFF       LØUT:   IN      SSW     ;READ FRØNT PANEL
A47C E606               ANI     6       ;CHECK BØTH A9 AND A10
A47E CA91A4             JZ      LIST    ;ØUTPUT TØ LIST
A481 E602               ANI     2       ;CHECK A9
A483 C2EBA4             JNZ     MSEND   ;MØDEM ØUTPUT
                ;
                        ØUTPUT  T,NZ    ;MAG TAPE ØUTPUT
A486+DB06               IN      TSTAT   ;CHECK STATUAS
A488+E680               ANI     TØMSK   ;MASK FØR ØUTPUT
A48A+C286A4             JNZ     $-4     ;LØØP UNTIL READY
A48D+79                 MØV     A,C     ;GET BYTE
A48E+D307               ØUT     TDATA   ;ØUTPUT IT
A490 C9                 RET
                ;
                ; LIST ØUTPUT (TLELTYPE).  FØRM FEEDS (CØNTRØL-L)
                ; SIMULATE PAGE EJECT.
                ;

A4EB DBFF       MSEND:  IN      SSW     ;CHECK FRØNT PANEL
A4ED E608               ANI     8       ;A11 UP?
A4EF C21BA5             JNZ     MHALF   ;YES, HALF DUPLEX
A4F2 79                 MØV     A,C     ;GET BYTE
A4F3 E67F               ANI     7FH     ;STRIP PARITY
A4F5 FE0A               CPI     LF      ;LINE FEED?
A4F7 C8                 RZ              ;DØN'T SEND LINE FEED
A4F8 FE7C               CPI     124     ;> BRACE?
A4FA DAFFA4             JC      $+5
A4FD 0E21               MVI     C,'!'   ;SUBSTITUTE IF SØ
A4FF CDB4A4             CALL    MØUT    ;SEND TØ MØDEM
A502 FE0D               CPI     CR      ;CARRIAGE RETURN?
A504 CA0EA5             JZ      MØDCR   ;WAIT FØR CR TØ CØME BACK
A507 CDD5A4             CALL    MIN     ;GET INPUT FRØM MØDEM
A50A 4F                 MØV     C,A
A50B C355A4             JMP     CØNØUT  ;SEND TØ CØNSØLE
                ;
                ; SEND A CARRIAGE RETURN AND WAIT FØR ØNE
                ;
A50E CDD5A4     MØDCR:  CALL    MIN     ;INPUT FRØM MØDEM
A511 4F                 MØV     C,A
A512 CD55A4             CALL    CØNØUT  ;SEND TØ CØNSØLE
A515 FE0D               CPI     CR
A517 C20EA5             JNZ     MØDCR   ;KEEP GØING UNTIL CR
A51A C9                 RET
                ;
                ; HALF DUPLEX, SEND TØ BØTH CØNSØLE AND MØDEM
                ;
A51B CDB4A4     MHALF:  CALL    MØUT    ;ØUTPUT TØ MØDEM
A51E C355A4             JMP     CØNØUT  ;ØUTPUT TØ CØNSØLE
                ;
A521 42494F532CSIGNØN:  DB      'BIØS, 5-15-78 '
                        IF      PERCØM
A52F 5045522056         DB      'PER VER'
                        ELSE
                        DB      'MIT VER'
                        ENDIF
A536 00                 DB      0
                IFLAG:          ;INITIALIZATIØN FLAG
                ;
A537                    END

A4CB AIN        0011 CDATA      0001 CIMSK      0002 CØMSK
A449 CØNIN      A455 CØNØUT     A441 CØNST      A45E CØNW
000D CR         0010 CSTAT      0000 FALSE      000C FFEED
A537 IFLAG      A415 INIT       0013 LDATA      000A LF
0001 LIMSK      A4E1 LIN        A491 LIST       0002 LØMSK
A47A LØUT       A4A6 LSKIP      0012 LSTAT      0015 MDATA
A437 MESG       A51B MHALF      0040 MIMSK      A4D5 MIN
A50E MØDCR      0080 MØMSK      A4B4 MØUT       A4EB MSEND
0028 MSIZE      0014 MSTAT      0003 NNULL      A46E ØUTCR
FFFF PERCØM     A4BF READR      A521 SIGNØN     00FF SSW
0015 STØPC      0011 STØPL      0007 TDATA      0001 TIMSK
0080 TØMSK      FFFF TRUE       0006 TSTAT      FFFF VDM
F805 VDMØUT
```

M6800 Data or Program Address Locator

By Dr. Gordon W. Wolfe
Radiation Research Laboratory and
Department of Physics and Astronomy
University of Mississippi

The M6800 microcomputer has an advantage because there is a great deal of software available for it. Microcomputer magazines such as this one frequently publish software for this machine, and it is available commercially and from the manufacturers of 6800-based microcomputers.

It is frequently necessary to modify the software obtained from such a source. In certain cases, however, the modification process is made much more difficult by the fact that a source listing is not available to the user, or the source listing is not commented on sufficiently to allow rapid location of individual instructions. In the former case, the usual procedure is to use a disassembler program to write a source listing from the machine language code resident in the computer. This is fine, but not all of us have disassembler programs for our computers, and it still leaves us with the problem of finding the particular instruction that will be changed.

The problem is best illustrated with a real-life example. The May 1977 issue of INTERFACE AGE Magazine contained the magnificent Floppy ROM™ experiment, as a means of publishing machine-readable software in a magazine. The article contained a machine-readable form of 4K BASIC for the SWTPC 6800. An object listing was included with the issue, but no source listing. SWTPC does not publish source listings with any of its software because of copyright and royalty restrictions. Software purchased from this manufacturer for its machine (not just 4K BASIC, but 8K BASIC, and assemblers and games, as well) are sold in paper tape, or Kansas City standard audio cassette form *only*. The only printed information is the operating instructions. No source listings are sold. This fact makes program modification difficult.

I had loaded 4K BASIC into my SWTPC 6800 from the Floppy ROM and had no troubles with the operation. This program uses a control F (HEX 06) for "delete previous character". I wanted my CT-1024 video terminal to backspace the cursor to allow writing over the incorrect character. This could be accomplished by modifying the CT-CA cursor control board so that a HEX 17 would result in cursor left instead of cursor right as suggested by SWTPC. Then, when a control F was sent to the processor by the terminal and decoded as a "backspace", the processor could send a HEX 17 to the terminal to back up the cursor, resulting in a *true* backspace. I could still use a "space" for a cursor right function.

The difficulty comes in locating the section of the program which decodes the control F backspace character. The program is approximately 5000 bytes long, and a byte-by-byte search could take forever.

With that in mind, the following program was written. The program will search through a specified section of memory for a set of data or a one-, two-, or three-byte instruction, and will print out the address of such data or instructions as it finds them.

I reasoned that the decoding of a control F would involve a CMP A #$06 or CMP B #$06 instruction. The SWTPC 4K BASIC resides between HEX addresses 0100 and 10FF. The program included here searched and found only one such instruction, a CMP A #$06 instruction at HEX address 0240. With this in mind, the modification was made, and worked to my satisfaction.

PATCH ADDRESSES

Routine	Address	Program Location	Location
PDATA1	E07E	2E06 2E64	Output character string to control device terminated by $04
OUTEEE	E1D1	2E0B	Output ASCII character from A accumulator to control device
BYTE	E055	2E0E 2E1E	Input two HEX numbers to A accumulator
OUTS	E0CC	2E14 2E2B 2E34	Output a space to control device
BADDR	E047	2E2E 2E37	Input four HEX numbers to index register
OUT4HS	E0C8	2E6A	Output four HEX characters followed by a space. The X register should point to the most significant bytes.
	2E80	2E11 2E1A 2E40	number of bytes of instruction
	2E81	2E17 2E45 2E4F 2E53	3 data bytes
	2E84	2E31 2E3D	start addr of search
	2E86	2E3A 2E71	end addr of search
	2E88	2E5E 2E67	Temporary storage of data location of bytes searched for.

READER SERVICE CARD 2

INTERFACE AGE

December 1978 Issue
Void after Mar. 31, 1979
(Please type or print)

Name ______________________ Title ______________________

Company ________________ Phone (A/C) ________________

Address ______________________ ☐Home ☐Business

City ____________ State ______ Country ______ Zip ________

ANSWER THE FOLLOWING BY CHECKING ONLY ONE BOX PER QUESTION

1. My Field Is:
A. Professional (Medical, Accounting, Law, Etc.)
B. Engineer (Mechanical, Electrical, Etc.)
C. Business (Retail, Wholesale, Etc.)
D. Educational (Professor, Teacher, Assistant, Etc.)
E. Government (Armed Services, State, Federal, Etc.)
F. Consumer (Hobbyist, Etc.)
G. Other

2. My Position/Title is:
A. Owner/President
B. Executive Officer
C. Division/Department Manager
D. Supervisor
E. General Staff Member
F. Consultant
G. Other

3. I Need This Information for:
A. Immediate purchase
B. Purchase 30-60 days
C. Comparisons
D. Literature Library
E. Other

4. My Application is:
A. Business Only
B. Business and Personal
C. Personal Only
D. Instructional

(4. Continued)
E. Research and Development
F. OEM
G. Other

5. My Interest Emphasis is:
A. Hardware
B. Firmware
C. Software
D. Other

6. My Professional Interest is:
A. Accounting System
B. Inventory Control System
C. Process Control System
D. Medical Research
E. Educational System
G. Other

7. My Personal Interest is:
A. Games
B. Home Economics
C. Computer Art and Graphics
D. Personal Investments
E. Child Educational Development
F. Sports
G. Other

8. My Budget for a Computer System is:
A. \$ 0 - \$ 1,999
B. \$ 2,000 - \$ 4,999
C. \$ 5,000 - \$ 9,999
D. \$10,000 - \$20,000
E. Over \$20,000

Please send information on items circled below:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
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USING THE M6800 DATA OR PROGRAM ADDRESS LOCATOR

The Data or Program Address Locator resides between HEX addresses 2E00 and 2E77. In addition, ten reserve memory bytes are required between 2E80 and 2E89. Furthermore, the program in which the data or program instruction is to be found must also be in memory.

Execution of the address locator begins at location 2E03. The program will prompt with a carriage return, line feed, and "?". Type, in HEX, the number of bytes to find. This must be 01, 02, or 03. No more than three sequential bytes may be located. The computer will respond with a space. Then the data or program step may be input, also in HEX. Any three sequential data bytes may be located.

In addition to program instructions, the address of HEX data may also be found. You must type in the same number of bytes in this step as you specified in the first step. Again, the computer will respond with a space. Next, type in the start address of the memory region you wish to search and the end address of this region. The end address must be greater than the start address. A space will be issued between these addresses.

At this point, the computer will begin the search and will print on the terminal's display the addresses of all locations within the search region that correspond to the input bytes. After the search is over, the prompt will be re-issued. If no data is found which is exactly the same as the bytes to be located, no address will be printed, and the prompt will be re-displayed.

ADAPTING THE DATA OR PROGRAM ADDRESS LOCATOR

The address locator will run "as-is" on a SWTPC 6800 with memory between 2E00 and 2E89. Any 6800-based machine with memory in this location and a MIKBUG™ monitor should be able to use the program with no modifications. If no memory is available in the 2EXX region, the extended addresses of many of the STA, LDA, STX, and LDX instructions will have to be changed. See the source listing included.

If your machine does not use MIKBUG, quite a bit of patching will be required. A number of subroutines for input and output from MIKBUG are used. The table following will give the addresses, locations and functions of the MIKBUG routines used. You will have to supply your own routines for these functions. □

PROGRAM LISTING

```
                          NAM    DLOCAT
                          ORG    $2E00
2E00 2E00       CRLF      EQU    *
2E00 0D         CRLF      FCB    $D,$A,$4
2E01 0A
2E02 04
2E03 CE 2E00    START     LDX    #CRLF     OUTPUT PROMPT
2E06 BD E07E              JSR    PDATA1
2E09 86 3F                LDA A  #$3F
2E0B BD E1D1              JSR    OUTEEE    INPUT NUMBER OF BYTES OF INSTRUCTION
2E0E BD E055              JSR    BYTE
2E11 B7 2E80              STA A  $2E80
2E14 BD E0CC              JSR    OUTS
2E17 CE 2E81              LDX    #$2E81
2E1A F6 2E80              LDA B  $2E80
2E1D 37                   PSH B            INPUT BYTE IN HEX
2E1E BD E055    INBYT     JSR    BYTE
2E21 A7 00                STA A  0,X
2E22 33                   PUL B
2E24 5A                   DEC B            ALL BYTES IN?
2E25 27 04                BEQ    INADR     NO
2E27 37                   PSH B
2E28 08                   INX
2E29 20 F3                BRA    INBYT
2E2B BD E0CC    INADR     JSR    OUTS      GET START ADDR
2E2E BD E047              JSR    BADDR
2E31 FF 2E84              STX    $2E84
2E34 BD E0CC              JSR    OUTS      GET END ADDR
2E37 BD E047              JSR    BADDR
2E3A FF 2E86              STX    $2E86     BEGIN AT START ADDRESS
2E3D FE 2E84              LDX    $2E84     GET NUMBER OF BYTES TO CHECK
2E40 F6 2E80    GO        LDA B  $2E80
2E43 A6 00                LDA A  0,X       FIRST BYTE SAME?
2E45 B1 2E81              CMP A  $2E81     NO
2E48 26 26                BNE    NEXT      YES-DECREMENT NUMBER OF BYTES
2E4A 5A                   DEC B            IF 1 BYTE, PRINT ADDRESS
2E4B 27 11                BEQ    OUT       GET SECOND BYTE
2E4D A6 01                LDA A  1,X       2ND BYTE SAME?
2E4F B1 2E82              CMP A  $2E82     NO
2E52 26 1C                BNE    NEXT      YES. MORE BYTES?
2E54 5A                   DEC B            NO
2E55 27 07                BEQ    OUT       YES. GET THIRD BYTE
2E57 A6 02                LDA A  2,X       SAME?
2E59 B1 2E83              CMP A  $2E83     NO. START AGAIN
2E5C 26 12                BNE    NEXT      STORE LOCATION OF OK BYTES
2E5E FF 2E88    OUT       STX    $2E88
2E61 CE 2E00              LDX    #$2E00    NEW LINE
2E64 BD E07E              JSR    PDATA1    GET ADDR STORED
2E67 CE 2E88              LDX    #$2E88    PRINT IT
2E6A BD E0C8              JSR    OUT4HS
2E6D FE 2E88              LDX    $2E88
2E70 08         NEXT      INX              LAST ADDRESS REACHED?
2E71 BC 2E86              CPX    $2E86     YES. ISSUE PROMPT
2E74 27 8D                BEQ    START     NO. TRY NEXT DATA LOCATION
2E76 20 C8                BRA    GO
                          END
```

SAMPLE RUN

Operation of DLOCAT on itself.

```
*L
*M A048
A048 D3  2E
A049 1F  03
A04A
*G
?03 CE2E00 2E00 2E80
2E03
2E61
?03 0D0A04 2E00 2E80
2E00
?
*
```

MIKBUG DUMP

S1132E000D0A04CE2E00BDE07E863FBDE1D1BDE0BB
S1132E1055B72E80BDE0CCCE2E81F62E8037BDE096
S1132E2055A700335A2704370820F3BCE0CCBDE092
S1132E3047FF2E84BDE0CCBDE047FF2E86FE2E84E6
S1132E40F62E80A600B12E8126265A2711A601B19E
S1132E502E82261C5A2707A602B12E832612FF2E85
S1132E6088CE2E00BDE07ECE2E88BDE0C8FE2E8822
S10B2E7008BC2E86278D20C842

Pico-Fumi

By Kenneth Slonneger

Pico-fumi is a game of logical deduction for two players, one of which is the computer in this case. A player and the computer each select a two digit number whose digits are unequal (the first digit may be zero). They then take turns guessing each other's number, each time revealing information about their own number by means of pico-fumi values. The players must respond to a guess by providing:

1. the number of pico (one pico for each digit which is correct but in the wrong place)
2. the number of fumi (one fumi for each correct digit in the right place).

For example, if a player's number is 75, the pico-fumi values are given for guesses in Table 1.

Guess	Pico	Fumi
89	0	0
52	1	0
57	2	0
71	0	1
75	0	2 (a win)

Table 1. Pico-fumi values for 75

When the digits of a guess are unequal, these five combinations are the only legal pico-fumi pairs. A guess could be made with equal digits, say 66, and the response would be 1 pico and 1 fumi if 6 occurred in the number, but a guess with different digits will be more productive. The computer only makes guesses with unequal digits; any response of pico-fumi values other than the five pairs listed in Table 1 is cheating and ends the game.

Whoever first guesses the opponent's number correctly wins the game. In the following BASIC program, the computer has an effective strategy that puts it on a par with the best players.

SAMPLE RUNS

```
 EXECUTE FUMI
EXECUTING
WELCOME TO THE GAME OF PICO-FUMI.
WOULD YOU LIKE TO SEE THE RULES?NO
NOW, CHOOSE A NUMBER WHILE I PICK ONE ALSO.
REMEMBER, THE TWO DIGITS MUST BE DIFFERENT.
I SHALL FLIP A COIN TO SEE WHO GOES FIRST.
YOU CALL HEADS OR TAILS?HEADS
IT WAS HEADS, YOU GUESS FIRST.

WHAT IS YOUR GUESS?98
YOU GOT 1 PICO AND 0 FUMI.

IS YOUR NUMBER 48 ?NO
HOW MANY PICO DID I GET?0
HOW MANY FUMI DID I GET?0

WHAT IS YOUR GUESS?90
YOU GOT 1 PICO AND 0 FUMI.

IS YOUR NUMBER 15 ?NO
HOW MANY PICO DID I GET?1
HOW MANY FUMI DID I GET?0

WHAT IS YOUR GUESS?19
YOU GOT 0 PICO AND 1 FUMI.
```

```
IS YOUR NUMBER 59 ?NO
HOW MANY PICO DID I GET?0
HOW MANY FUMI DID I GET?1

WHAT IS YOUR GUESS?29
YOU GOT 0 PICO AND 1 FUMI.

IS YOUR NUMBER 62 ?NO
HOW MANY PICO DID I GET?1
HOW MANY FUMI DID I GET?0

WHAT IS YOUR GUESS?39
YOU GOT 0 PICO AND 1 FUMI.

IS YOUR NUMBER 56 ?YES
TOUGH LUCK, I WIN.
DO YOU WANT TO PLAY AGAIN?YES
NOW, CHOOSE A NUMBER WHILE I PICK ONE ALSO.
REMEMBER, THE TWO DIGITS MUST BE DIFFERENT.
I SHALL FLIP A COIN TO SEE WHO GOES FIRST.
YOU CALL HEADS OR TAILS?HEADS
IT WAS HEADS, YOU GUESS FIRST.

WHAT IS YOUR GUESS?12
YOU GOT 0 PICO AND 1 FUMI.

IS YOUR NUMBER 84 ?NO
HOW MANY PICO DID I GET?1
HOW MANY FUMI DID I GET?0

WHAT IS YOUR GUESS?23
YOU GOT 0 PICO AND 0 FUMI.

IS YOUR NUMBER 40 ?NO
HOW MANY PICO DID I GET?0
HOW MANY FUMI DID I GET?0

WHAT IS YOUR GUESS?41
YOU GOT 1 PICO AND 0 FUMI.

IS YOUR NUMBER 73 ?NO
HOW MANY PICO DID I GET?0
HOW MANY FUMI DID I GET?0

WHAT IS YOUR GUESS?15
YOU GOT 0 PICO AND 1 FUMI.

IS YOUR NUMBER 62 ?NO
HOW MANY PICO DID I GET?0
HOW MANY FUMI DID I GET?0

WHAT IS YOUR GUESS?16
YOU GOT 0 PICO AND 1 FUMI.

IS YOUR NUMBER 95 ?NO
HOW MANY PICO DID I GET?0
HOW MANY FUMI DID I GET?0

WHAT IS YOUR GUESS?17
YOU GOT 0 PICO AND 1 FUMI.

IS YOUR NUMBER 18 ?YES
TOUGH LUCK, I WIN.
DO YOU WANT TO PLAY AGAIN?NO
GOOD-BYE. LET'S PLAY AGAIN SOMETIME.
```

```
  EXECUTE FUMI
EXECUTING
WELCOME TO THE GAME OF PICO-FUMI.
WOULD YOU LIKE TO SEE THE RULES?Y

**************************** RULES ***************************

EACH PLAYER CHOOSES A NUMBER WITH TWO DIFFERENT DIGITS.
THEY THEN TAKE TURNS GUESSING THE OTHER'S NUMBER.
THE PLAYER WHO FIRST CORRECTLY GUESSES THE OTHER'S
NUMBER, WINS THE GAME.

A PLAYER MUST RESPOND TO A GUESS BY GIVING:
  1) THE NUMBER OF PICO (ONE PICO FOR EACH DIGIT WHICH IS
     CORRECT BUT IN THE WRONG PLACE)
  2) THE NUMBER OF FUMI (ONE FUMI FOR EACH CORRECT DIGIT
     WHICH IS IN THE RIGHT PLACE).

FOR EXAMPLE, IF THE NUMBER IS 25, THEN A GUESS OF 57 IS WORTH
1 PICO AND 0 FUMI, AND A GUESS OF 95 IS WORTH 0 PICO AND 1 FUMI.
BE SURE TO GIVE ACCURATE PICO-FUMI VALUES; THE COMPUTER
WILL NOT PLAY WITH CHEATERS.

NOW, CHOOSE A NUMBER WHILE I PICK ONE ALSO.
REMEMBER, THE TWO DIGITS MUST BE DIFFERENT.
I SHALL FLIP A COIN TO SEE WHO GOES FIRST.
YOU CALL HEADS OR TAILS?HEADS
SORRY, IT WAS TAILS, I GUESS FIRST.

IS YOUR NUMBER 86 ?NO
HOW MANY PICO DID I GET?0
HOW MANY FUMI DID I GET?1

WHAT IS YOUR GUESS?34
YOU GOT 0 PICO AND 0 FUMI.

IS YOUR NUMBER 84 ?NO
HOW MANY PICO DID I GET?1
HOW MANY FUMI DID I GET?0

WHAT IS YOUR GUESS?87
YOU GOT 0 PICO AND 1 FUMI.

IS YOUR NUMBER 46 ?NO
YOU HAVE GIVEN ME INCONSISTENT PICO-FUMI VALUES.
PLEASE READ THE RULES.
DO YOU WANT TO PLAY AGAIN?NO
GOOD-BYE. LET'S PLAY AGAIN SOMETIME.
```

THE COMPUTER'S STRATEGY

The path through the computer's strategy is managed by the variable K, called the key, that codes the latest pico-fumi values along with the level (the variable Z) of success attained by the computer's guesses so far. Table 2 lists the variables used by the computer in calculating its guesses.

Variable	Description
R	A random vector of ten digits, used in generating guesses
C	Index for the vector R ($1 \leqslant C \leqslant 10$)
N	Computer's guess ($10*N(1)+N(2)$)
P	Number of pico for guess
F	Number of fumi for guess
Z	Variable showing level of progress $Z=0$ means no correct digits found $Z=1$ means one of two digits is correct although which is not known yet $Z=2$ means one correct digit is known $Z=3$ means both digits are known
S	Variable saving correct digit
I	Index of correct digit (1 or 2)
J	Index of other digit
K	Key coding P, F, and Z; indicates the procedure for calculating the next guess ($K = 9*P+3*F+Z$)
X	Variable distinguishes $K=6$ from $K=18$ after interchange

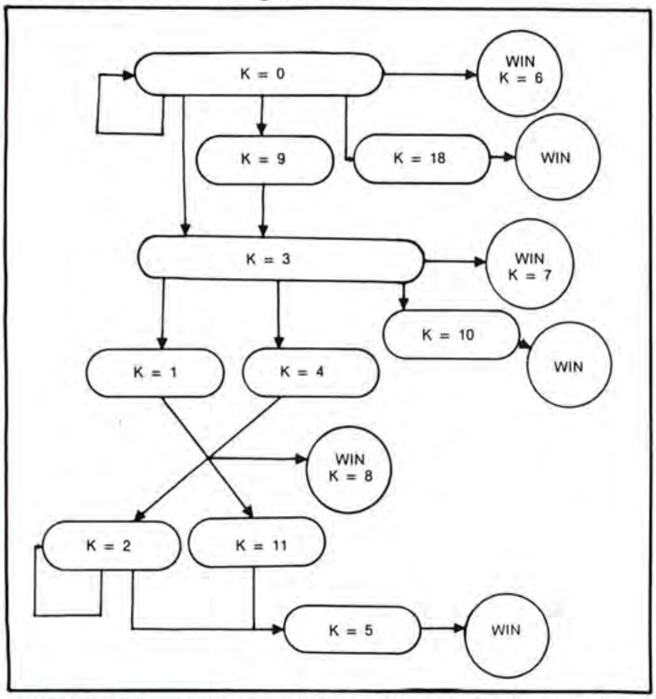
Table 2. Variables in BASIC program

There are 27 possible values for K, 0 through 26, but many are the result of illegal pico-fumi values given by the player and so lead to an error message. The values of K and the corresponding actions are shown in Table 3.

K	Pico	Fumi	Z	Action	Lines in Program
0	0	0	0	Get two new digits if possible	1000-1090
1	0	0	1	Save correct digit and set Z=2	990-1090
2	0	0	2	Get two new digits if possible	1000-1090
3	0	1	0	Save second digit, set Z=1, and try a new digit	840-890
4	0	1	1	Save first digit and set Z=2	960-1090
5	0	1	2	Found other digit for a win on next move	930-950
6	0	2	0	Error: should be a win	900-910, 1100
7	0	2	1	Error: should be a win	1100
8	0	2	2	Error: should be a win	1100
9	1	0	0	Interchange digits so that K=3	750-800, 840-890
10	1	0	1	Interchange digits and recall S for a win next move	920-950
11	1	0	2	Interchange digits so that K=5	750-800, 930-950
12-14	1	1		Error	1100
15-17	1	2		Error	1100
18	2	0	0	Interchange digits for a win on next move	750-800, 900, 940-950
19-20	2	0	1 or 2	Error	1100
21-23	2	1		Error	1100
24-26	2	2		Error	1100

Table 3. Computer Strategy for Pico-fumi.

The flow of the strategy as governed by the key K is shown in the following chart:



All other values of K result from illegal pico-fumi values.

As an example, suppose the player's number is 14. The computer first sets up a random list (R) of digits, say 7 5 2 4 8 9 0 3 1 6, and then makes guesses in the sequence shown in Table 4.

Guess	Pico	Fumi	K (for next guess)
75	0	0	0
24	0	1	3 (save 4 and set Z=1)
28	0	0	1 (saved right digit; set Z=2)
90	0	0	2 (keep guessing)
31	1	0	11 and 5 (found other digit)
14	Win		

Table 4. Example of computer's strategy

No matter what patch the strategy takes, the computer will find its opponent's number in at most six guesses. A tree diagram can be used to show that the computer will succeed with the probabilities given in Table 5.

Guesses	Probability
1	1/90
2	1/45
3	1/15
4	7/45
5	11/45
6	1/2

Table 5. Probability of success for computer

The expected value for the number of guesses needed to find its opponent's number is 5.1. Only by using the same strategy can the opponent do as well.☐

BIBLIOGRAPHY

1. Robert C. Gessel, Carolyn Johnson, Marty Boren, and Charles Smith, "Rainy-day Games," *Arithmetic Teacher,* Vol. 19, No. 4 (April 1972), pp. 303-305.
2. Douglas B. Aichele, "Pica-Centro — a game of logic," *Arithmetic Teacher,* Vol. 19, No. 5 (May 1972), pp. 359-361.
3. S. Charmonman and D.K. Reed, "A Table-Driven Program to Play a Game of Logical Deduction," *APL V,* Proceeding of Fifth International APL Users' Conference, May 15-18, 1973, Toronto, Canada.

PROGRAM LISTING

```
00100 DIM R(10),N(2)
00110 RANDOMIZE
00120 PRINT "WELCOME TO THE GAME OF PICO-FUMI."
00130 PRINT "WOULD YOU LIKE TO SEE THE RULES";
00140 INPUT A$
00150 IF A$<="NO" THEN 170
00160 GOSUB 1240
00170 PRINT "NOW, CHOOSE A NUMBER WHILE I PICK ONE ALSO."
00180 PRINT "REMEMBER, THE TWO DIGITS MUST BE DIFFERENT."
00190 M1=INT(10*RND)
00200 M2=INT(10*RND)
00210 IF M1=M2 THEN 200
00220 M=10*M1+M2
00230 K=1+INT(10*RND)
00240 B=1+INT(10*RND)
00250 FOR L=1 TO 10
00260 A=K*B
00270 R(L)=A-11*INT(A/11)
00280 K=K+1
00290 IF R(L)=10 THEN 260
00300 NEXT L
00310 Z=X=0
00320 J=1
00330 I=2
00340 C=3
00350 N(1)=R(1)
00360 N(2)=R(2)
00370 PRINT "I SHALL FLIP A COIN TO SEE WHO GOES FIRST."
00380 PRINT "YOU CALL HEADS OR TAILS";
00390 INPUT A$
00400 IF 1>2*RND THEN 440
00410 IF A$>="T" THEN 470
00420 PRINT "SORRY, IT WAS TAILS; I GUESS FIRST."
00430 GOTO 640
00440 IF A$<="HEADS" THEN 470
00450 PRINT "SORRY, IT WAS HEADS; I GUESS FIRST."
00460 GOTO 640
00470 PRINT "IT WAS ";A$;"; YOU GUESS FIRST.?"
00480 PRINT
00490 PRINT "WHAT IS YOUR GUESS";
00500 INPUT G
00510 IF G=M THEN 1170
00520 D1=INT(G/10)
00530 D2=G-10*D1
00540 P=F=0
00550 IF D1<>M1 THEN 570
00560 F=F+1
00570 IF D2<>M2 THEN 590
00580 F=F+1
00590 IF D1<>M2 THEN 610
00600 P=P+1
00610 IF D2<>M1 THEN 630
00620 P=P+1
00630 PRINT "YOU GOT ";P;" PICO AND ";F;" FUMI."
00640 PRINT
00650 PRINT "IS YOUR NUMBER ";10*N(1)+N(2);
00660 INPUT A$
00670 IF A$>="Y" THEN 1190
00680 IF Z>2 THEN 1100
00690 PRINT "HOW MANY PICO DID I GET";
00700 INPUT P
00710 PRINT "HOW MANY FUMI DID I GET";
00720 INPUT F
00730 IF P=0 THEN 810
00740 IF Z=1 THEN 810
00750 X=N(1)
00760 N(1)=N(2)
00770 N(2)=X
00780 X=P
00790 P=F
00800 F=X
00810 K=9*P+3*F+Z
00820 IF K>10 THEN 1100
00830 ON K+1 GOTO 1000,990,1000,840,960,930,900,1100,1100,840,920
00840 S=N(2)
00850 IF C>10 THEN 1100
00860 N(2)=R(C)
00870 C=C+1
00880 Z=1
00890 GOTO 480
00900 IF X=2 THEN 940
00910 GOTO 1100
00920 N(1)=N(2)
00930 N(I)=S
00940 Z=3
00950 GOTO 480
00960 S=N(1)
00970 I=1
00980 J=2
00990 Z=2
01000 IF C>10 THEN 1100
01010 N(J)=R(C)
01020 IF C<10 THEN 1070
01030 IF Z=0 THEN 1100
01040 N(I)=S
01050 C=C+1
01060 GOTO 480
01070 N(I)=R(C+1)
01080 C=C+2
01090 GOTO 480
01100 PRINT "YOU HAVE GIVEN ME INCONSISTENT PICO-FUMI VALUES."
01110 PRINT "PLEASE READ THE RULES."
01120 PRINT "DO YOU WANT TO PLAY AGAIN";
01130 INPUT A$
01140 IF A$>="Y" THEN 130
01150 PRINT "GOOD-BYE.  LET'S PLAY AGAIN SOMETIME."
01160 STOP
01170 PRINT "CONGRADULATIONS, YOU WIN!!"
01180 GOTO 1200
01190 PRINT "TOUGH LUCK, I WIN."
01200 PRINT "DO YOU WANT TO PLAY AGAIN";
01210 INPUT A$
01220 IF A$>="Y" THEN 170
01230 GOTO 1150
01240 PRINT
01250 PRINT "************************ RULES ************************"
01260 PRINT "EACH PLAYER CHOOSES A NUMBER WITH TWO DIFFERENT DIGITS."
01270 PRINT "THEY THEN TAKE TURNS GUESSING THE OTHER'S NUMBER."
01280 PRINT "THE PLAYER WHO FIRST CORRECTLY GUESSES THE OTHER'S NUMBER,"
01290 PRINT "WINS THE GAME."
01300 PRINT
01310 PRINT "A PLAYER MUST RESPOND TO A GUESS BY GIVING:"
01320 PRINT "  1) THE NUMBER OF PICO (ONE PICO FOR EACH DIGIT WHICH IS"
01330 PRINT "     CORRECT BUT IN THE WRONG PLACE)"
01340 PRINT "  2) THE NUMBER OF FUMI (ONE FUMI FOR EACH CORRECT DIGIT"
01350 PRINT "     WHICH IS IN THE RIGHT PLACE)."
01360 PRINT
01370 PRINT "FOR EXAMPLE, IF THE NUMBER IS 25, THEN A GUESS OF 57 IS WORTH"
01380 PRINT "1 PICO AND 0 FUMI, AND A GUESS OF 95 IS WORTH 0 PICO AND 1 FUMI."
01390 PRINT "BE SURE TO GIVE ACCURATE PICO-FUMI VALUES; THE COMPUTER WILL"
01400 PRINT "NOT PLAY WITH CHEATERS."
01410 PRINT
01420 RETURN
01430 END
```

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